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PSYCHE

VOL. 54 MARCH, 1947 No. 1

SYNOPSIS OF WEST COAST *CERCERIS*[1] (HYMENOPTERA, CERCERIDÆ)

BY NATHAN BANKS
Holliston, Mass.

The first species of *Cerceris* described from this area was *C. californica* by Cresson in 1865. Since then Provancher described one, Viereck one, Mickel five, and the author several. Having received some additional material, I have put all in synoptic form. Several species described by Viereck and Cockerell from New Mexico occur in southern Arizona, and in a few cases in southern California, so I have included such as I know to occur in southern Arizona.

It has been impossible to be sure in every case to associate the sexes correctly; in some instances either of two species might belong to one of the opposite sex from what is now known, therefore I have described such forms separately.

In the males I find that the shape of the middle lobe of the clypeus and the breadth of the hair-lobes are very useful. The sculpture of the enclosure, though usually fairly constant in each species, is sometimes variable, so of less value than previously considered by writers. The sculpture of the pygidium is less variable, but often similar in several species; the general shape of the pygidium, and the crest of hair at sides quite constant, although often differing in the sexes.

Length and density of hair are also of use. There is little to be found (so far) in the wing, the length of the pedicel of the second submarginal cell is different in a few species. The pale markings are more constant than in many insects; these, and the punctation, and the shape of the clypeal process in the female are of basic importance.

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[1] Published by a grant from the Museum of Comparative Zoology at Harvard College.

In several of the species in this paper, *isolde*, *femur-rubrum*, *orestes*, *thione*, the lower part of the outer edge of the lateral lobes is fitted to the edge of the eye for a short distance; this occurs in some of the European species and is the normal condition in the subgenus *Apiratrix*.

Some have used the number of spines on the hind tibia as of specific value, but in our species it is not dependable. In a few species the males have the ends of the last ventral ridge developed, and provided with blunt teeth. In these species the lateral lobe does not reach the eye.

The two subgenera may be distinguished by the following:

At base of second ventral segment is a slightly raised area, often semicircular in outline; the stigma of the fore wings is brown to almost black *Apiratrix*.
No raised area at base of second ventral segment; stigma yellowish to ferruginous *Cerceris*.

SUBGENUS CERCERIS Latr.

The majority of the species, and all of the larger ones belong to this subgenus.

CERCERIS FEMALES

1. No distinct clypeal process with a free apical edge, or not raised above general surface 2
A distinct clypeal process, with free apical edge well raised above the general surface of clypeus 6
2. No band on second segment of abdomen 3
A yellow band on part or whole of second segment 4
3. Face below antennæ pale yellowish, except the narrow black lower border of clypeus; supraclypeal carina very long and high, bands on fourth and fifth segments quite broad *orestes*
Face below antennæ with much black; the hump on

clypeus and the outer part of lateral lobes only yellowish, lateral face-marks mostly above clypeus. *insolita*

4. Hind femora wholly pale; abdomen with all segments broadly yellow; venter mostly yellowish, spots on vertex .... *arno*

Hind femora black, venter also, and other femora mostly black 5

5. Small; with pale band on third ventrite, scape wholly black; first segment small, not equal one-half of second behind; abdomen coarsely punctate, enclosure mostly smooth, with median groove .. *melanthe*

Rather large; scape with pale spot below; first segment of abdomen broad, equal to one-half of second behind, enclosure roughened, irregularly striate; abdomen finely punctate .... *denticularis*

6. Clypeal projection in form of a large cone, the base occupying almost all of clypeal surface, tapering above to a point; wings brown, enclosure large, with a smooth pale spot in middle .... *macrosticta*

Clypeal projection not in form of such a large cone 7

7. The projection, short, edge concave, with two membraneous plates hanging beneath; propodeum with or without lateral stripes .... *femur-rubrum*

The projection has no such plates pendent beneath 8

8. Clypeus with one or two small pointed teeth a little above lower margin of clypeus 9

The process on clypeus is of other shape 10

9. Two teeth on clypeus; very large species, with very broad face .... *grandis*

One tooth only on clypeus; rather small species; face of normal width .... *athene*

10. All femora largely black, venter black, clypeal process twice as broad as long, not divided, black beneath. *nigrescens*

Femora not black, if partly black then venter has much yellow 11

11. Very large, almost wholly yellowish or rufous, last joint of antennæ wholly black; second submarginal cell very large, sides strongly convex, pedicel not

one-third of height of cell; last segment of abdomen with a sharp tooth each side before end; clypeal process divided into two horns .... *frontata*

Not so wholly yellowish or rufous species; last joint of antennæ partly rufous; second submarginal cell not so large; scape (first joint) of antennæ not twice as long as third joint 12

12. Clypeal process broad, divided into two divergent horns 13

Clypeal process without divergent horns 15

13. The separation of horns reaches nearly to base of process 14

The separation reaches hardly more than one-half the length of process; hind femora dark toward tip; enclosure obliquely striate .... *eurymele*

14. Venter black, second segment with a median carina; all femora yellow or rufous; enclosure finely, longitudinally striate .... *sexta*

Venter with much yellow, no carina on second segment; front and mid femora black on base; enclosure more coarsely and obliquely striate *sextoides*

15. Body largely rufous or yellowish; wings quite dark; clypeal process small, lower margin broadly emarginate, and a sharp tooth each side on clypeal margin under the outer corners of clypeal process; enclosure rufous, punctate on sides .... *fidelis*

Enclosure black, striate 16

16. Hind femora, and others, a nearly uniform rufous or yellow 17

Hind femora pale yellowish, tip black, other femora black on base; scape black above 18

17. Tip of clypeal process well raised above clypeus, sides parallel; enclosure obliquely striate .... *nasica*

Clypeal process depressed, slightly tapering, tip hardly its breadth above clypeal surface; enclosure longitudinally striate, scape pale above .... *vicina*

18. Clypeal process, but little elevated, much broader than long, margin broadly truncate .... *varians*

Clypeal process about as long as broad, subtriangular, tapering to black, well elevated .... *æqualis*

MALES

1. Hind femora pale on base, with a large dark mark near tip; clypeus truncate below ... 2

   Hind femora all dark, all pale, or pale on apical part ... 8

2. Yellow bands on abdomen so broad on sides as to leave only a median triangular dark spot in front; clypeus with three teeth below; pygidium partly yellow; hair-lobes little more than twice their breadth apart, venter with complete yellow bands 3

   Yellow bands on abdomen not so much broadened on sides, always some black laterally; pygidium black ... 5

3. Yellow bands on abdomen deeply indented with black in front; hair on propodeum moderately long; hair-lobes not as broad as clypeal truncation *sextoides*

   Yellow bands on abdomen scarcely indented with rufous, wide throughout; hair on propodeum very long; hair-lobes about as broad as clypeal truncation ... 4

4. First segment black, pale on sides; head without rufous; bands on abdomen broad, scarcely indented; enclosure obliquely longitudinally striate; teeth of clypeus small ... *eurymele*

   First segment rufous, bands sometimes indented with rufous; back of head with some rufous; enclosure obliquely striate on sides, behind with short cross striæ crossing the median groove; teeth of clypeus large ... *nasica*

5. Hair-lobes not twice their breadth apart ... 6

   Hair-lobes about three times their breadth apart . 25

6. Hair on face (from side) very long; clypeal margin evenly truncate below, no teeth; pygidium plainly narrowed toward base ... *varians*

   Hair on face very short; clypeal margin with three teeth below; pygidium not narrowed toward base; first segment broader than long ... 7

7. Enclosure strongly longitudinally striate; second segment band scarcely broader than others; face plainly narrowed above ... *æqualis*

Enclosure rather large, swollen, smooth, with mid groove, a few short striæ in each corner; band on second segment much broader than others; face but little narrowed above .... *posticata*

8. Second abdominal segment without a pale band, hind femora almost wholly brown to black 9

Second segment with distinct pale band 10

9. Face almost wholly pale; band on first segment, pale marks on pronotum, scutellum and often on sides of propodeum; venter with some yellowish *orestes*

Face with only narrow lateral marks pale, no band on first segment, no marks on scutellum nor propodeum, lower face with much silvery hair. *semiatra*

10. A tuft of yellowish spreading hair at each side of pygidium; third submarginal cell with rounded sides; stigma and marginal cell elongate 11

No such tuft of hair each side of pygidium 12

11. Face with dense, erect, very long hair, longer than scape, much long hair elsewhere; yellow bands do not cover the segments at sides; venter black; propodeum and abdomen (except bands) black. *englehardti*

Face with very short hair, scarcely noticeable, yellow bands (except one on second segment) usually cover entire side, venter spotted, thorax and abdomen usually partly rufous .. .. *fidelis*

12. Enclosure with a smooth pale spot in middle; pygidium broader than long; scape and hair lobes long. *macrosticta*

No such pale area in enclosure, pygidium longer than broad 13

13. Hind femora wholly black at least on inner side, the black of several segments hardly reaches margin 14

Hind femora paler, rufous or yellowish on apical part 15

14. Venter black; the yellow of bands leaves a black crescent ending shortly before lateral margin. *denticularis*

Venter with yellow spots; yellow of bands leave a somewhat diamond-shaped black mark open only to middle part of front margin .... *completa*

15. Hair-lobes less than the breadth of one apart; yellow of clypeus comes to a point in middle of front edge; femora rufous, body black with yellowish marks; abdomen strongly convex transversely .... *thione*

Hair-lobes plainly separated by more than breadth of one of them 16

16. Tip of antennæ black; third joint slender, longer than fourth, marginal cell and stigma very slender; second submarginal cell with curved sides; legs mostly yellowish to rufous; second submarginal cell very large, face much narrowed in middle 17

Tips of antennæ rufous; face less narrowed; second submarginal cell normal size, pedicel full one-half of cell 18

17. Third antennal joint a little longer than the first (scape); face narrowed above, near end of lateral face marks becoming wider again, upper side of lateral lobes curved, supraclypeal mark not above antennæ; hair on vertex, thorax and abdomen grey to reddish brown, on face yellowish white; second submarginal cell very large, sides much curved, pedicel about one-third of cell height .... *orphne*

Third antennal joint not as long as the long scape; face still more narrowed above than in *orphne;* upper side of lateral lobes straight; hair on body mostly white to light grey, ventral fringes white, face with snow-white hair; second submarginal cell still larger, sides more curved, and pedicel less than one-third of cell height .... *frontata*

18. Third antennal joint much longer than the fourth, and a little longer than the first (scape), fourth joint three times as long as broad; enclosure obliquely striate; clypeus impressed above the slightly raised three-toothed margin; pygidium with parallel sides; abdomen black, with subequal bands above and lateral spots below .... *sexta*

Third joint not longer than scape; fourth joint not nearly three times as long as broad 19

19. Yellow of clypeus ends below in a point; upper side of the triangular lateral lobes is straight; little if any rufous on propodeum or abdomen 20

Yellow of clypeus ends broadly below, and at lower margin; often some rufous on thorax and abdomen; lateral lobes with upper side curved ending in a black comma-mark 21

20. A row of white hair across lower face from eye to eye; hair-lobes very narrow; spots on scutellum; enclosure smooth, but anterior corners with a few oblique striæ; sometimes lateral spots on propodeum; venter with little if any yellow. *femur-rubrum*

No row of white hair across lower face; hair-lobes moderately broad, yellow; no spots on scutellum; enclosure with median groove and each side with coarse oblique striæ; venter with yellow bands; sternum with rather long, erect white hair *vicina*

21. First segment of abdomen plainly longer than broad; face with lateral lobes wholly pale yellowish; propodeum reddish, smooth and shining; clypeal margin slightly rounded, pygidium slender, sides nearly parallel; lateral spots on venter *ferruginor*

First segment not plainly longer than broad; the dorsal surface usually broader than long 22

22. Third joint of antennæ plainly longer than fourth, fourth and fifth both rufous; clypeus projecting below nearly the height of lateral lobes in a short truncate margin; pygidium not twice as long as broad in middle, hind tibia has two basal teeth with an elongate base *isolde*

Third joint of antennæ barely if any longer than fourth, ventral punctate areas reduced to a narrow row in the middle 23

23. Venter black, trace of rufous on the sides; clypeal process truncate; propodeum, first, and base of second segment reddish, abdomen slender, the punctate side-lobes of venter much swollen so that

they project below, viewed from side; the ridge on sixth ventral forms a sloping rounded lobe with several teeth on the margin *calodera*

Venter with yellow spots or bands; the swollen areas are scarcely noticeable from side view; clypeal projection very faintly tridentate, or the margin at least biconcave 24

24. Lateral face marks reach little above antennæ; rather broad at end, supraclypeal mark also short; scutellum black, or at most with small spot each side. pygidium slender, sides nearly parallel; lateral lobe of sixth segment broadly rounded behind and with two large, black, blunt teeth; and usually some smaller connecting row or ridge with small teeth; the lateral lobe of fifth segment, though fairly long, also shows some small teeth near inner end and hind border *populorum*

Lateral face marks reach toward top of eyes, supraclypeal mark extends to anterior ocellus; sometimes spots or band on vertex, and a curved mark back of each eye; scutellum usually broadly yellowish or rufous; propodeum usually wholly rufous, or black; enclosure large, smooth; pygidium with the sides converging toward tip; the lateral lobe of the venter of sixth segment is broad, convex, and shows several rounded teeth, three on the outer corner; lobe of fifth segment has no distinct teeth. *illota*

25. Enclosure longitudinally striate *nigrescens*

Enclosure mostly obliquely striate *abbreviata*

Cerceris macrosticta V. & C.

Viereck and Cockerell, Jour. N. Y. Ent. Soc., 12: 133, 1904.

A female from Tucson, Arizona, July (Bequært).

Cerceris frontata Say

Say, West. Quart. Rept., 2: 80, 1823.

Leconte Ed., 1: 167, 1859.

From Flagstaff, Arizona, 29 July (Carpenter); Palmerlee, Arizona (Biedermann), and Colton, California (Pilate).

Cerceris sexta Say

Say, Bost. Jour. Nat. Hist., 1: 382, 1837.
Leconte Ed., 2: 763, 1859.

This belongs to the group of *frontata*, but I have not seen it west of Wyoming and Utah.

Cerceris sextoides sp. nov.

Female. In general similar to *sexta* (*biungulata*) and to *eurymele*, but the clypeal process is more widely emarginate than in either, and the horns of the process much more slender and sharply pointed, and not at all angulate at the base of the emargination. The markings are similar to those species, the abdomen with a broad band on each segment, emarginate in the middle of the front; the venter is black on the first and basal half of the second segment. Front and mid femora partly black (not in *sexta*) and the hind femora partly dark above. The hair and sculpture are about as in *eurymele*.

The male is more slender than in *eurymele*, the second and following segments hardly more than two-thirds as broad as in *eurymele*, and the yellow bands are more narrow; the venter has yellow bands or lateral spots, the hair lobes not as broad as the clypeal truncation. The femora of all legs have some black, the hind femora with a large black spot at tip.

Length of ♀ 12 mm., of ♂ 11 to 12 mm.

Holotype ♀ from Lone Tree, Yakima River, Wash., 30 June 1882 (S. Henshaw); allotype and paratypes from Nelson's, Yakima River, 4–5 July, and Camp Umatilla, 26 June, both Washington and by Mr. Henshaw; also from Davis, Calif., 1 July (Bohart), and one "California." Type M.C.Z. no. 23547.

Cerceris grandis Bks.

Banks, Bull. Amer. Mus. Nat. Hist., XXXII: 423, 1913.
Type from Ft. Yuma, Arizona.

Cerceris eurymele sp. nov.

Female. Black, face below antennæ pale yellowish, the front edge of the clypeal process slightly reddish, the lateral spots extend a little above antennæ, basal half of mandibles yellowish, a large elongate spot back of the eyes and basal joint of antennæ yellow, the next four joints and the last joint pale rufous, others dull black; two spots on pronotum, tegulæ, small spot on pleura below tegulæ, postscutellum, and a stripe each side on propodeum yellow. Abdomen with two large spots, almost touching, on first segment; second, third, and fourth with a broad band, occupying almost entire width except a rather square black space in middle of front margin, band on fifth segment also broad, but without indentation; sides of apical segment yellow, and venter with four very broad bands; tip below with some long brown hairs each side; legs mostly yellowish, hind femur with a small dark mark before tip on inner side, hind tibiæ with larger dark mark at tip; extreme bases of front and mid femora black; front basitarsus with six long even bristles on outer side. Wings yellowish hyaline, dark streak beyond the reddish stigma.

Body densely and rather finely punctate; hair on head moderately short, on thorax above shorter, longer hair on back of head, lower pleura, and sides of propodeum. Clypeal process very large, on the plan of *C. sextoides*, but the basal part is much longer, and the lateral parts not so divergent, the tips being very blunt. Enclosure strongly, obliquely striate, rather more coarsely than in *sextoides*, basal segment broader than long, second segment hardly twice as broad behind; pygidium very finely granulate, tip rounded, at base fully once and a half as wide as at tip, sides with fringe of yellow hair.

Male very similar, spot back of eyes small, spots on propodeum sometimes small, yellow bands on abdomen broadly and shallowly emarginate in front, black spots on legs larger; hair on head and thorax very long; pygidium with parallel sides, truncate at tip, and less than twice as long as broad; face of moderate width, mid lobe of clypeus one and one-half times as high as broad, lower margin with three teeth; hair lobes as broad as the truncate edge (broader than in *sextoides*), from side the clypeus is somewhat depressed below, and above very faintly convex, and with much rather long hair.

Length of ♀ 15 mm., of ♂ 13 mm.

The female holotype from Davis, Calif., 30 June (Bohart), M.C.Z. no. 23546, and males from El Cajon, Calif., May 1 (Van Duzee), and Santa Barbara, Calif., 18 July (Cockerell), Riverside, Calif., 4 Oct. (Melander). Very similar to *C. sextoides* but the clypeal process is different, the males with broader hair-lobes, longer hair on body, and the yellow bands on abdomen broader in the middle.

Cerceris englehardti sp. nov.

Male. Body finely punctured; entire body densely clothed with erect, very long hair, white on face, brown on vertex and mesonotum, rest of thorax grey but white on sternum, first segment of abdomen grey hair above, other segments yellowish, venter with dark grey on extreme side, most of venter without hair. On the face some hair is as long as the scape, on vertex longer than scape, on mesonotum somewhat shorter, but on propodeum again longer, quite long above on first segment, but shorter on other segments.

Black, with yellowish markings; face pale yellowish, extending higher than usual, supraclypeal mark reaching the anterior ocellus; scape pale below, dark above, third joint mostly pale all over, beyond the joints are black, but the extreme tip of last is rufous; third joint nearly as long as the scape; pronotum with two yellow spots, a tiny spot on middle of postscutellum, rest of thorax black; no spot on first segment of abdomen, second segment with band very broad on sides, reduced to a line in middle, other segments with band less broad and broadly emarginate in front. Legs yellowish to rufous, front femora black except tip; second femora with black mark at posterior base; third tibia rufous on apical half, basal half paler. Wings quite clear but broadly darkened along outer margin beyond marginal cell, stigma yellow, veins dark.

Clypeus a little higher than broad, swollen on upper part, lower edge with three black teeth; lateral lobes higher than broad, upper edge curved, for a short distance the lobe is against the eye, hair-lobes no broader than lateral lobe and several times their breadth apart, of short white hair. From above the sides of head behind eyes are incurved; hind ocelli fully as near eyes as to each other, enclosure smooth, with a shallow median groove. First segment of abdomen one and one-half times as broad as long, more than one-half of width of second segment behind, no ridge separates dorsum from basal slope. Second segment little longer than third, about as broad as third. Last segment with dense, spreading hair each side of pygidium, latter nearly twice as long as broad in middle, tip truncate, almost as broad as at middle, with fine punctures. Venter shining black, second ventrite longitudinally sculptured, but punctate on sides as other ventrites; the tip of subgenital plate is more narrow than the tip of pygidium, and the corners only slightly projecting, not spine-like. Hind tibia has seven spines above in the row. Wings with a long and clear marginal cell, second submarginal cell large, the pedicel fully one-third of height of cell, the end of second discoidal is further beyond end of cell than in most species.

Length 16 mm.

A male from St. John, Arizona, 27 July 1931 (G. P. Englehardt). Type M.C.Z. no. 27638.

Cerceris orestes sp. nov.

Female. Black with white to pale yellowish marks, coarsely punctate much as in *C. insolita.* Face below antennæ mostly white, the separated spots of *insolita* are here united, lower edge of clypeus black, supraclypeal mark reaches only to antennæ, rest of high carina black, lateral face-marks reach plainly above antennal fossæ, tip truncate. Lower margin of clypeus slightly convex, with six blunt, black teeth, two near middle closer together; white of clypeus broader than high, the comma-mark above middle, lower third of upper side of lateral lobe against eye; interantennal carina very high and short. Scape white below, above black and black out to the rufous last joint; hind ocelli nearer to eyes than to each other, small pale spot back of upper eye.

Two pale spots on pronotum, a band on scutellum, and a long stripe on propodeum, this has a recurved hook at upper end just below sides of enclosure, latter is coarsely punctate, much as on propodeum. First segment of abdomen with a pale yellowish band, sometimes with sides extended forward; third segment wholly pale above, fourth and fifth segments with a broad emargination in front; venter with two or three yellowish spots each side; pygidium fully as long as broad in middle, ends equals two-thirds of middle width.

Legs mostly black, front and mid femora pale on outer half below, basitarsus pale, rest brown, hind femora pale at tip, tibiæ pale beneath, tarsi dark.

Wings hyaline, fore wings with a broad dark costal streak, covering marginal cell and widened a little toward tip, second submarginal cell broad and low, the pedicel almost as long as height of cell.

Face with some white hair, vertex with some dark, but most of body with little and short as in *C. insolita.*

Length of female 9.5 to 11 mm.

Male. Similar to female, but face wholly pale below the antennæ and lateral face-marks not extending so high. The clypeus is higher than broad, a little swollen, lower edge quite short, and with two stout, blunt teeth near middle. Mandibles almost entirely black, extreme tip rufous; third antennal joint plainly a little longer than fourth. Other marks much as in female except on propodeum only a small spot or dot pale, and on venter are two or three pale bands; the wings have the same dark costal streak; enclosure mostly punctured as on propodeum; pygidium much as in female, fully twice as long as broad in middle, tip truncate, fully equal base and about two-thirds of middle width, sides a little curved, with large punctures and black hair; end of subgenital plate with a fairly long, sharp spine each side.

Length of male 6 to 8.5 mm.

From Patagonia, Arizona, 1 to 4 August (Bequaert). Type M.C.Z. no. 27637.

Cerceris insolita Cress.

Cresson, Proc. Ent. Soc. Phila., 5: 129, 1865.

One female from Tucson, Ariz., July (Bequaert).

Cerceris solidaginis Rohw.

Rohwer, Can. Ent., 1908: 323.

This species, separated on males from *femur-rubrum* on having the enclosure with large punctures, not smooth in middle, and no pale lateral mark on propodeum. Of five females before me two have the stripe on propodeum, are larger, broader, three without the stripe are smaller, less broad, and therefore have a slightly less broad clypeal process. In the numerous males most are without the stripe on propodeum, two with only a dot; the sculpture of the enclosure in most of the specimens is more or less irregular. I doubt if it is a distinct species, but the name may be of use for a lower category. Specimens of each form were taken at Tempe on the same dates.

Cerceris femur-rubrum Vier. & Ckll.

Viereck and Cockerell, Jour. N. Y. Ent. Soc., 12: 135, 1904.

No record from California, but since it is very common at Tempe, Arizona, it may occur in southern California. It is structurally much like the eastern *C. compacta,* but much more yellow.

Cerceris fidelis Vier. & Ckll.

Viereck and Cockerell, Jour. N. Y. Ent. Soc., 12: 132, 1904.

Have none from California, but it is so common at Tempe and Tucson, Arizona, it quite possibly occurs in southern California.

Cerceris orphne sp. nov.

Male. Face yellowish, not reaching above antennæ, lateral face-marks truncate above, with moderately short whitish hair, denser long dark hair on vertex. Face broad below, plainly narrowed at antennæ. From side the clypeus is swollen above, below depressed and the free edge is raised a little; this process is short, truncate, each side is thickened and almost makes a blunt tooth at outer corner; hair-lobes almost as broad as lateral lobes; face rather finely and closely punctate; scape of antennæ yellow below, rufous above, second and third joints rufous, beyond becoming deep black, last joint without the rufous. Pronotum with a large yellow spot on each side; band on postscutellum and a short lateral yellowish stripe on propodeum each side; enclosure mostly smooth, a broad median groove, some very short striæ in anterior angles; propodeum with longer and paler hair than on mesonotum. Abdomen rather slender; first segment rufous in middle, yellow on sides, other segments with moderately broad bands on sides, emarginate in middle; venter black, with four yellow spots each side, mostly tapering to point at inner end. Second ventrite longitudinally sculptured; pygidium broad, sides diverging above, one and one-half times as long as broad in middle, with numerous small punctures. Legs pale, the inner base of front and mid femora ferruginous, the hind femora with apical half a little darker than rest; hind tibiæ not darkened near tip, tarsi pale; teeth on hind tibiæ above much sloping. Wings fumose darker on upper part and near tip, stigma and marginal cell elongate; second submarginal about as large as in *frontata*, the sides much curved, pedicel hardly one-third of height of cell.

Length 16 mm.

One male from Jemez Springs, New Mexico, 2 July (Englehardt). Type M.C.Z. no. 23536.

Cerceris æqualis Prov.

Provancher, Add. Hym. Can., 417, 1888.

Female. Black, bases of mandibles, spot on each side of lateral lobe, large one on clypeal process, basal joint of antennæ below, stripe each side by eyes, spot behind eyes, yellowish. Two small spots on pronotum, tegulæ, postscutellum, two spots on first segment, bands on second, third, and fourth, narrow in middle, broad on sides, all about equal, venter with three bands, and last segment with two spots, all yellowish or yellow.

Clypeal projection from above almost triangular, below it is black, and a spine each side on margin of clypeus; enclosure moderately large, rather finely longitudinally striate; pygidium about two and one-half times as long as wide at base, much narrowed toward the tip, dark fringe each side. Front and mid femora dark on base, hind femur and tibia dark on tip, hind tarsus very dark, except a narrow line above on basitarsus. Wings with dark front part, most prominent beyond the yellowish stigma. Body rather finely punctate, hair on head and thorax moderately long.

Male very similar in coloration, but the bands on abdomen are less broad on sides, and the spots on first segment are smaller. The clypeal truncation has three teeth, the hair-lobes about as broad as the truncation; face, from side, is rather short-haired; enclosure longitudinally striate as in the female; pygidium broadly truncate at tip, its base scarcely more narrow, coarsely punctate, one and a half times as long as broad.

Length of ♀ 12 mm., of ♂ 10 mm.

Type of Provancher was simply California, a male. I have identified as it a male from San Mateo Co., Calif., 20 June, and a female from Big Flat, Coffee, Trinity Co., Calif. The description of Provancher would fit the male of *C. varians* just as well.

This species is close to *C. varians,* but the clypeal process is much more elevated, and there is no mark on the propodeum.

In male the face has shorter hair than *varians,* there are teeth on the truncation of clypeus, and the pygidium is scarcely more narrow at base.

Cerceris abbreviata Bks.

Banks, Can. Entom., 1919, 84.

Specimens from Yakima, Little Spokane, Camp Umatilla, all Washington, in July (Henshaw), and Carrville, Trinity Co., Calif., 27 May.

Cerceris completa Bks.

Banks, Can. Entom., 1919, 83.

Have seen only the type from Claremont, Calif.

Cerceris nigrescens Smith

Smith, Cat. Hymen. Brit. Mus., IV: 466, 1856.

Specimens from Wawawai (W. M. Mann); Wenass Valley, 7 July (Henshaw); Spokane, 21 June (Henshaw); Ainsworth, 20 July (Henshaw); and Gulf of Georgia (A. Agassiz), all in Washington. Also occurs in Montana, British Columbia, and eastward.

Cerceris varians Mickel

Mickel, Nebr. Univ. Studies, XVII: 336, 1917.

Paratype before me from Donner Lake, Calif.; others from Mammoth, 17 Sept.; Sequoia National Park, 25 July; and San Mateo County, 20 June, all in California.

Cerceris munda Mickel

Mickel, Nebr. Univ. Studies, XVII: 337, 1917.

Described from Sacramento, Calif. I have not seen it.

Cerceris thione sp. nov.

Male. Black; markings pale yellowish, the face verging to white; most of mandibles, basal joint of antennæ, a small spot back of eyes, pronotum wholly, tegulæ, spot below tegulæ, scutellum, postscutellum and a fairly broad stripe each side on propodeum, pale yellowish; rest of antennæ brown, but rufous below for a few joints and the last joint also rufous. Each segment of abdomen with an apical band, that on second plainly broader than those behind, none much widened on sides; venter with lateral yellow spots on third, fourth, and fifth segments. Legs yellowish, front and mid femora rufous on base, hind femora rufous, darker on lower edge; more than apical half of hind tibiæ black, hind tarsi nearly black, except basitarsi. Wings almost hyaline, brown, beyond the yellowish stigma, the tip more broadly brown.

Hair of face short, white, vertex and thorax densely dark-haired, on propodeum long and white, that on abdomen above longer than usual. Body densely and rather finely punctate.

Mid lobe of clypeus projects triangularly below, and the white hair-lobes are much less than their breadth apart, from side the clypeus is evenly convex; enclosure mostly smooth and shining, sides punctate; basal segment of abdomen much broader than long, fully one-half the apical width of second segment, the abdomen rather broad; pygidium very broad, hardly one and a half times longer than broad, tip truncate, sides somewhat convex; the hind tibiæ are more swollen toward tip than usual, and the outer spines are very prominent.

Length 10.5 mm.

From Colton, Calif. (Pilate), Eddy Collection, 24 August and 4 September, and Claremont, Calif. (Baker). One specimen from Colton is only 8 mm. long. Type M.C.Z. no. 23593.

Cerceris arno sp. nov.

Female. Largely yellowish, face wholly, basal half of the mandibles, and basal joint of antennæ, yellow; vertex with a yellow spot each side from top of eye toward the middle, a very large yellow spot back of eye. Pronotum wholly, tegulæ, a spot below it, yellow, below latter is a rufous stain; scutellum, postscutellum, and most of the sides of propodeum yellow, leaving only a median dark stripe and this is partly rufous; basal segment of abdomen reddish at base, rest yellow, broad bands on next four segments, that on second with a median dark spot in front, the third and fourth acutely emarginate in front with dark, the fifth entirely yellow; the terminal segment yellow, except the rufous to brown pygidium; venter almost wholly yellow, some segments narrowly dark at base; legs almost wholly yellowish to rufous, the tarsi, especially the hind tarsi, darker, and a faint dark mark at tip of hind tibiæ.

Wings yellowish hyaline, yellow-brown in front, stigma yellowish.

Face with much silvery white hair, not very long, but dense, moderately short hair on vertex, thorax, and abdomen. Punctures dense, but not coarse. Mid lobe of clypeus somewhat swollen above, much broader than high, below with a broad truncation; enclosure mostly transversely striate; basal abdominal segment much broader than long; pygidium nearly three times as long as broad at tip, latter somewhat rounded, wider at base, at widest part (above middle) it is twice as wide as at tip, bordered with yellow fringe.

Length 10.5 mm.

From Colton, Calif. (Pilate), Eddy Collection, and mountains near Claremont (Baker). Type M.C.Z. no. 23542. One specimen has the sternum yellowish, and one has a reddish mark on the mesonotum.

Cerceris californica Cress.

Cresson, Proc. Ent. Soc. Phila., 5: 128, 1865.

Described from a male, possibly related to *C. denticularis*. But the legs brownish at base, four anterior femora ferruginous, posterior pair rufopiceous, tibiæ and base of tarsi yellow, is not like *denticularis*, nor is the unusually small first segment tinged with ferruginous at tip.

Cerceris denticularis Bks.

Banks, Bull. Mus. Comp. Zool., 51: 113, 1917.

Specimens from Umatilla, Oregon, and Yakima and Spokane, Wash.

Cerceris posticata Bks.

Banks, Ent. News, 1916, 64.

Described from the Jemez Mts., New Mexico (Woodgate).

Cerceris vicina Cress.

Cresson, Proc. Ent. Soc. Phila., 5: 120, 1865.

Male from Raton Pass, New Mexico, 26 July (James).

Cerceris nasica V. & C.

Viereck and Cockerell, Jour. N. Y. Ent. Soc., 12: 132, 1904.

Jemez Springs, New Mexico, 2 July (Englehardt); 29 June, 2 July (Woodgate).

Cerceris athene sp. nov.

Female. Black; clypeus and bases of mandibles rather rufous, sides of face yellow, back of eyes, also somewhat rufous, a yellow spot near upper end of eye; on vertex back of ocelli are two transverse yellow marks, almost united to form a curved band; basal joint of antennæ rufous, beyond brown; pronotum with the spots almost united; tegulæ rufous on inner part, yellow on outer half; yellow spot just below tegulæ, and below that is a rufous stain; scutellum, postscutellum, and a stripe each side on propodeum, yellow.

First segment of abdomen fully one-half yellow; second yellow, with a median indentation; third broad on sides, narrow in middle; fourth and fifth bands fainter and very narrow; second and third segments of venter yellowish. Legs almost entirely rufous, tarsi dark; wings brownish along front and more definite near tip.

Middle clypeal lobe swollen, and ending in a small median cone-like point, no free edge; enclosure smooth in middle, punctate on sides; pygidium with tip truncate, base about as wide as tip, sides curved so that the widest part is a little above the middle, it is fully one and two-thirds as broad as at tip, rather densely granulate; basal segment of abdomen fully one-half of the second at tip.

Length 10.5 mm.

From Claremont, Calif. (Baker). Type M.C.Z. no. 23537. *C. thione* may be the male.

Cerceris melanthe sp. nov.

Female. Black; face below antennæ, base of mandibles, pronotum, tegulæ, postscutellum and a spot on each posterior side of propodeum, pale yellowish. On abdomen an apical band on each segment; that on first narrow, that on second covering about half of segment, angularly emarginate in middle, those on other segments less wide, but covering about one-half of segment, and more deeply emarginate in front; venter with a large pale yellow spot on each side of third segment. Femora almost wholly shining black, front and mid femora pale at extreme tips, hind trochanters pale, rest of front and mid legs pale, in hind legs fully the apical half of the tibiæ and the tarsi black. Wings hyaline, stigma reddish, beyond is a broad brown streak.

Body rather coarsely punctate, much as in the section with the dark stigma; hair on face short and silvery, but long on edges of lateral lobes, that on vertex dark, on pleura and propodeum longer and pale, abdomen scarcely hairy above, below with a band of rather short hairs on each segment.

Face moderately broad below, no clypeal process, and the broad middle lobe scarcely reaches below the lateral lobes; enclosure with a median groove and the sides roughened, but hardly striate; basal joint of abdomen about as long as broad, not half the apical width of second segment; pygidium elongate, narrowed at each end, more so at base, fully two and a half times as long as broad in middle; the front tarsi (except basal joint) are more broad than usual; teeth on upper edge of hind tibiæ very strong.

Length 6 mm.

From Apache Co., Santa Catalina Mts., Ariz., 25 July, 5500 ft., J. Bequaert collector. Type M.C.Z. no. 23539.

Cerceris calodera sp. nov.

Male. Small, body slender; face fairly broad, barely narrowed at middle; face pale yellowish, with silvery hairs, and white hair-lobes; lateral face marks and supraclypeal mark reach only a little above antennæ. Clypeus swollen, lower margin slightly concave each side and projecting a little in middle, the process broad and truncate. Antennæ short, thick toward the tip, under side of tip rufous, scape pale. Pronotum broadly yellow, the spots nearly touching; mesothorax black, coarsely punctate, two small rufous spots, one on tubercle, other below wing-base; a faint spot each side on scutellum, band on post-scutellum; propodeum rufous, black in middle and enclosure, latter broad, smooth.

Abdomen slender, first segment rufous, its dorsum plainly broader than long; second segment rufous on base, behind is a broad yellow band, narrower bands on other segments, but broader on sides; abdomen from side shows the lateral lobes of venter roundedly projecting below more than in allied species; venter black, a trace of rufous on sides. Each ventral segment, back of second, shows a bristly punctate lobe each side, and connecting punctate ridge in middle. On sixth segment the ridge is elevated, each side into a broad lobe, with several fairly large teeth grouped around the outer corner. Pygidium slender, sides nearly parallel, and nearly twice as long as broad in middle, tip truncate. Legs almost wholly yellowish, tips of hind tibiæ dark, and hind tarsi dusky.

Length 9 mm.

One from Jacumba, Calif., 12 August 1917 (W. M. Wheeler). Type M.C.Z. no. 27622.

Cerceris illota sp. nov.

Male. Face yellowish, the lateral and supraclypeal marks tend to extend upward toward top of eyes and the anterior ocellus, sometimes connected with spots or band on vertex; with short, silvery hair, hair-lobes no broader than lateral lobes. Usually a comma-shaped rufous spot back of each eye, and sometimes a rufous band across vertex from eye to eye, often absent, or two spots. Antennæ with scape pale, second and third joints usually rufous, beyond brown, but tip of last joint rufous, third not longer than fourth. Pronotum with the yellow spots meeting; mesonotum black, stained with rufous, or all rufous, a yellow spot under base of fore wings; scutellum usually rufous, postscutellum yellow; pleura and propodeum black to rufous, yellow stripe each side on propodeum; enclosure fairly broad, smooth, but with one or two punctures in upper corners.

First segment of abdomen rufous, dorsum plainly broader than long; second segment more than twice as broad behind as first, sides broadly convex, a nearly square rufous or black spot indenting the broad yellow band covering the rest of the segment; other segments completely covered with yellow band, sometimes slightly indented in front with rufous; from above the segments show the denticulate appearance at outer hind corners. Venter black, with pale yellowish, punctate spots on side narrowly connected across middle. Pygidium one and one-half times as long as broad in middle, tip usually a little narrowed. Sixth ventrite has a lobe each side tipped with several black (or rufous) teeth, many blunt.

Legs yellowish to rufous, hind femora darker than others, front and mid femora with some large spots of white; hind tibiæ dark beyond middle, hind tarsi dusky.

Wings dark along costa and towards tip as usual.

Length 9 to 11 mm.

From Tucson, Arizona, August (Bequaert), also Patagonia, Arizona, 20 August (Bequaert), and Colton, Southern California, 16 August (Pilate); also two from Palmerlee, Arizona (Biedermann). Type M.C.Z. no. 23541.

Cerceris isolde sp. nov.

Male. Face wholly yellowish up to upper edge of antennal fossæ, with short silvery hair, most dense toward lower margin; hair-lobes yellowish, short; antennæ mostly rufous out to seventh joint, thence black, but the last joint is rufous, and scarcely curved. Face not very broad below and little narrowed above; lateral lobes high, outer side straight, and fully one-third its length against eye. Clypeus projects below the lateral lobes and ends in a truncate process. Head back of eyes rufous.

Pronotum rufous, with two yellow spots above; mesonotum black, closely and coarsely pitted; scutellum broadly and a line on postscutellum yellow; propodeum rufous, the enclosure moderately large, mostly smooth, but a few punctures on sides; median groove on propodeum very distinct, lying in a depression; mesopleura rufous, sternum black.

Abdomen rather slender; dorsum of first segment almost twice as broad as long; second segment twice as broad behind, in front rufous as the first, behind with broad yellowish band, four similar bands behind occupying all of dorsum, last segment also yellow, all with fine whitish hair; pygidium one and one-fourth times as long as broad in middle, tip broad, sides little curved, little narrowed above. Venter with yellow bands, broad on sides, second ventrite yellowish; on the sixth there is a cross-ridge, but without teeth. Legs also wholly yellowish to rufous, hind tibia near inner tip faintly darkened.

Wings darkened in front and towards tip; marginal cell quite long and narrowed toward tip; pedicel of second submarginal fully one-half of cell's height.

Length 10 mm.

From Palmerlee, Arizona, Biedermann coll. Type M.C.Z. no. 23540.

Cerceris ferruginor V. & C.

Viereck and Cockerell, Jour. N. Y. Ent. Soc., 12: 134, 1904.

Described from New Mexico; I have one from Tucson, Arizona, July (Bequaert). The unusual length of the first segment readily distinguishes it.

Cerceris populorum V. & C.

Viereck and Cockerell, Jour. N. Y. Ent. Soc., 12: 135, 1904.

Tucson, Arizona (F. H. Snow).

Cerceris semiatra sp. nov.

Male. Deep black; from middle of third abdominal segment above to tip of abdomen yellow, and a narrow yellowish band on these segments below. On face is a narrow orbital streak, at top occupying hardly one-half of space between eye and antenna, and below running out before reaching the mandibles; the yellowish hair-lobes are short; face below antennæ with much rather long hair, in most views silvery. The antennæ (including scape below) are black. On the pronotum there is a trace of a narrow, yellowish line each side; no other pale on head nor thorax. Legs black, front and mid tibiæ show a pale streak on front side, tarsi more brown, but with white hair appear paler.

Fore wings with usual dark spot at tip; stigma and the veins before it yellow, veins beyond and behind stigma brown.

Face with nearly parallel sides, higher than broad; clypeus quite large, rounded above and on sides, below truncate, and not as coarsely punctate as rest of face. Antennæ as long as width of head, broadened toward tip, third joint short, but a little longer than fourth, a high carina between bases of antennæ. Mesonotum coarsely punctate, enclosure broad and smooth, propodeum very coarsely punctate. First abdominal segment with nearly parallel sides, not one-half the width of hind margin of second segment, latter quite long as usual, sides rounded in to front, surface coarsely punctate, third segment about as broad as second, others shorter; pygidium fully one and one-half as long as broad, tip truncate and more than one-half of base, sides slightly curved; ventral segments without definite fringes.

In fore wings, the third submarginal cell has an oblique base and sinuous tip, and is a little longer than broad, and beyond this cell the marginal cell tapers a little to tip.

Length 10 mm.

One male from Patagonia, Arizona, 20 August (Bequaert). Type M.C.Z. no. 27620.

SUBGENUS APIRATRIX SHEST.

This subgenus is easily separated not only by the original character of a small basal raised area on the second ventrite, but also by the darker color of the stigma, brown to black against the yellow to ferruginous of the typical forms; the lateral lobes reach the eye higher than in many of the true *Cerceris*, and in most of the species there is a mesosternal tubercle in the female.

APIRATRIX—FEMALES

1. Propodeum and base of abdomen rufous; face with three pale spots, lateral lobes black; clypeus with a small median, pointed cone *conifrons*
   Propodeum and base of abdomen not rufous, no pointed cone on clypeus 2
2. Front femora impressed on outer dark part when seen from above 3
   Front femora not impressed behind, convex; end of clypeus upraised a little, so with free, dark edge 4
3. Clypeus plainly swollen above, but not quite in a cone; white of clypeus not nearly twice as broad as long; apex of pygidium more than one-half its

greatest width; hind femora more than one-half black below .... *complanata*

Clypeus evenly convex; white of clypeus fully twice as broad as long; apex of pygidium not one-half its greatest width, hind femora not so much black. *vanduzeei*

4. Scape of antennæ pale above and below; often two spots on vertex; marks mostly white; enclosure punctate on sides .... *acanthophila*

Scape of antennæ dark above 5

5. Lateral face marks separated from clypeus by black; enclosure with transverse striæ . ... *viereckí*

Lateral face marks reach yellow of clypeus 6

6. Enclosure nearly cross-striate; clypeal lobe short, truncate; face-markings yellowish; pale abdominal bands deeply indented with black; yellow spots on venter .... *minax*

Enclosure largely smooth, not cross-striate 7

7. Enclosure smooth, no punctures; face with much white hair below; clypeal lobe broadly emarginate in middle; yellow of clypeus separated from lateral face marks by a black line; pygidium not especially slender nor narrowed more than usual toward tip; hair-lobes white, broad, partly on clypeus ...... *snowi*

Enclosure mostly smooth, but with some striæ or punctures; yellow of clypeus adjoins lateral face-marks 8

8. Enclosure with rather fine oblique striæ each side of median groove; pygidium not particularly slender near tip; clypeal margin scarcely elevated. *hesperina*

Enclosure mostly smooth but fine transverse striæ in upper part, the groove with lines across; pygidium very slender and apical third more narrowed; clypeal margin plainly a little elevated ..... *convergens*

APIRATRIX—MALES

1. First and second segments entirely jet black, rest of abdomen with yellow bands; hind legs almost

wholly black; lateral lobes black; hair-lobes so broad they almost touch each other *seminigra*
Second segment with a pale band 2

2. Propodeum and first segment reddish, face below antennæ wholly pale *conifrons*
These parts not reddish 3

3. Clypeus wholly black as also supraclypeal area; hind femora black almost to tip 4
Clypeus, at least, with a large pale spot 5

4. Enclosure partly punctate; lower face densely white-haired *snowi*
Enclosure smooth, corners finely striate; lower face not especially densely hairy *convergens*

5. Lateral lobes at least partly black 6
Lateral lobes wholly pale 8

6. A supraclypeal pale mark; clypeus higher than broad; enclosure cross-striate; body very slender. *arizonella*
No supraclypeal mark, at most a dot, body less slender, enclosure not cross-striate; clypeal lobe with three teeth or lobes 7

7. Lateral lobes partly pale; enclosure smooth; teeth of clypeus blunt, rounded; hair-lobes small *eriogoni*
Lateral lobes black; no spot on pleura, teeth sharp, mid tooth rounded *hesperina*

8. Scape pale above as below; marks white, face rather narrow; lower edge of clypeus trilobed. *acanthophila*
Scape dark above 9

9. Hind femora with apical third beneath pale, venter with some yellowish; two oblique stripes on propodeum 11
Hind femora with less than one-fourth pale; venter black, unspotted 10

10. Clypeus about as broad as high, broad on lower margin, comma-mark a little below middle of clypeus, clypeal edge short, truncate; hair-lobe not equal breadth of clypeal lobe, marks snow-white. *huachuca*

Clypeus plainly higher than broad, comma-mark plainly above middle, a noticeable mass of silvery hair on lateral lobes and lower clypeus somewhat obscuring the hair-lobes; marks yellow, hair-lobes nearly as broad as clypeal lobe *complanata*

11. Spots on scutellum and first segment; no pale marks on propodeum; enclosure with oblique striæ; pygidium oblong *cockerelli*

Band on scutellum and first segment; two oblique stripes on propodeum behind; enclosure transversely striated; pygidium slender, about equally narrowed at each end *vanduzeei*

Cerceris (*Apiratrix*) *convergens* V. & C.

Viereck and Cockerell, Jour. N. Y. Ent. Soc., 12: 136, 1904.

Several from Jacumba, Calif., 12 to 17 August (Wheeler); Patagonia, Ariz., 20 Aug. (Bequaert), and Apache Cp., Santa Catalina Mts., Ariz., 25 July, 5500 feet (Bequaert).

Cerceris (Apiratrix) huachuca sp. nov.

Male. Black, with snow-white marks. Face moderately narrow, white, with short white hair, longer at lower margin; clypeus scarcely higher than broad, comma-mark near middle; clypeal edge short, truncate, hair-lobes not quite as broad as clypeal edge; third joint of antennæ barely longer than fourth, scape above dark, two spots on pronotum, not meeting; two on scutellum, not far apart; line on postscutellum, two small spots, touching on first segment of abdomen; rather broad band on second segment, not broadened on sides; narrow band on tip of next four segments; pygidium twice as long as broad in middle, a little broader above, tip truncate; venter black. Very short pale hairs on abdomen, longer on first segment above, darker, but rather short, on mesonotum.

Hind femora black almost to tip, second femora and first black behind on basal two-thirds; enclosure smooth.

Length 5 mm.

From Patagonia, Arizona, 20 August (Bequaert). Type M.C.Z. no. 27636.

Cerceris (Apiratrix) eriogoni V. & C.

Viereck and Cockerell, Jour. N. Y. Ent. Soc., 12: 139, 1904.

Two from Tempe, 31 July, and 2 August (Bequaert).

Cerceris (Apiratrix) acanthophila Ckll.

Cockerell, Entom., 1897, 135.

Several from Arizona, Tempe, August 1 and 2 (Bequaert); August 5 (Wheeler); Tucson, July (Bequaert); Tucson, September 1–5 (Carpenter). Two females, 4 August, from Tempe, agree with the description of *C. chilopsidis* Vier. & Ckll. and are, I believe, the female of *acanthophila.*

Cerceris (Apiratrix) vierecki sp. nov.

Female. Black. Face with a large pale yellowish spot on middle lobe of clypeus, a spot on outer side of each lateral lobe, a supraclypeal spot, and an elongate spot each side by eye. This leaves on each side a black streak between the supra-clypeal mark and the eye-spot running down on the lateral lobe. Basal joint of antennæ pale beneath, also most of the mandibles, and a small spot behind each eye; most of the antennæ pale below and brown above. Pronotum with a spot each side, tegulæ, spot each side on scutellum, line on postscutellum, all yellowish; sometimes a spot below tegulæ.

Abdomen with a narrow apical band on the first segment, a broad band on the second, broadly emarginate in front; third and fourth segments with a more broadly emarginate band, very narrow in the middle; fifth with a narrow apical band, all yellowish; venter unspotted. Legs very pale, the femora largely black, front and mid pairs with apical fifth pale; hind tibiæ with large black spot over apical half, and the tarsi (except basitarsi) brown.

Wings faintly infumate, stigma brown, and a broad brown streak beyond. Body densely and rather coarsely punctate. Hair on face pale and very short, that on vertex and thorax longer and darker; propodeum and basal segment with long white hair, rest of abdomen hardly hairy above, and few hairs in the ventral bands.

Face moderately broad, border of mid lobe truncate; enclosure with middle groove, and coarsely transversely ridged; basal segment of abdomen broader than long, almost one-half the apical width of second segment; pygidium broader at base than at tip, about three times as long as wide at tip, sides slightly bowed.

Length 6 mm.

From Tempe, Arizona, 1 August (Bequaert). Type M.C.Z. no. 23544.

Cerceris (Apiratrix) convifrons Mickel

Mickel, Trans. Amer. Ent. Soc., XLII: 410, 1916.

Specimens from Tempe, Ariz., 31 July (Bequaert); described from Nebraska and Wyoming, having spread so far may extend into California.

Cerceris (Apiratrix) cockerelli Vier.

Viereck, Proc. Acad. Nat. Sci. Phila., 1902, 731.

Described from La Jolla, Calif.

Cerceris (Apiratrix) complanata Mickel

Mickel, Nebr. Univ. Studies, XVII: 340, 1917.

Described from Auburn, Calif. Specimens from Three Rivers, Calif., 12 to 14 July; and Antioch, Calif., in May and June.

Cerceris (Apiratrix) snowi Bks.

Banks, Can. Entom., 1919, 84.

Based on males from Tucson, Ariz. (Snow), and San Diego Co., Calif. (Van Duzee). I have also a male from Jacumba, Calif., 12 to 17 August (Wheeler), and females from Jacumba, Calif., 12 to 17 August, which are evidently this species.

They are larger than the males; agree with males in lacking a supraclypeal mark, but the clypeus is almost wholly pale, the lower edge of mid lobe black, and forming a slightly bilobed rim; lateral lobes with long silvery hair. Two small spots on scutellum (often absent in the male), a spot below tegulæ (usually absent in male), a spot on the pleural spine; basal segment with a small transverse line or two small spots (as in one of the male types); rest of abdominal marks are like those of the male, that on second broad, that on third broken in one female (as in all males). Legs have black femora, excepting tips of the front and mid pairs. The enclosure is smooth. The pygidium is long, almost to a point below, and with sides much bowed; the front tarsi are flattened.

Length of ♀ 10 mm.

Cerceris (Apiratrix) vanduzeei Bks

Banks, Bull. Mus. Comp. Zool., LXI: 114, 1917.

Types from San Diego Co., Calif., June (Van Duzee), and also from Claremont, Calif. (Baker).

Cerceris (Apiratrix) arizonella sp. nov.

A small very slender male with supraclypeal area wholly pale and wholly united with lateral face-marks, the latter do not extend down to mandibles, as the lateral lobes are black, antennæ pale rufous, scape beneath white; two white spots on pronotum, nearly meeting; dot on tubercle, two spots on scutellum, and a line on postscutellum, a spot on first segment of abdomen, fairly broad; band on second, and narrow, white bands on those behind, except that on the sixth segment is very faint; venter black.

Except face much like *acanthophila*, but more slender. Face more narrow than that species, the clypeus higher than broad, from side, evenly convex, lower margin convex; hair-lobes very short; antennæ quite slender, third joint much longer than fourth, last joint but little curved; mesonotum coarsely pitted, with little very short hair; propodeum roughened somewhat transversely, enclosure with transverse striæ. First segment of abdomen about as broad as long, sides slightly rounded, all segments coarsely punctate, third and fourth segments of equal width, pygidium small and slender, base about one-half width, tip about half the width of base, rounded, surface with a few large punctures.

In the fore wings the third submarginal cell is no longer than broad, beyond it the marginal cell is narrowed toward tip.

Length 5 mm.

One male from Tempe, Arizona, 1 August (Bequaert). Type M.C.Z. no. 23538.

Cerceris (Apiratrix) seminigra sp. nov.

Male. Deep black; first and second segments of abdomen jet black, no pale marks, third to sixth segments inclusive entirely yellow above. Venter with yellow spots on sides of segments four to sixth; face with lateral marks touching a large spot on clypeus, lateral lobes and face above clypeus black; long silvery hairs on face-marks and lower face; antennæ rufous, darker toward tip, scape below pale. Two small spots on pronotum, tegulæ, two fairly large spots on scutellum, all pale yellowish. Hind legs almost wholly black, a small pale streak at base of tibia above, front and mid legs wholly black on femora; tibiæ black except yellow on upper side; tarsi pale. Wings slightly fumose, darker in front toward tip, stigma brown.

Face rather wider above than below, clypeus rounded above and on sides, almost as long as broad, below convex; the white hair-lobes very broad, almost meeting in middle; a moderately high carina between antennæ; anterior ocellus hardly larger than others, and about one and one-half diameter from them. Antennæ short, not equal width of head, broader towards tip, third joint slender, much longer than the fourth. Hair on head and mesonotum plainly shorter than usual; enclosure smooth, with distinct mid groove. Abdomen rather short, first segment broader than long, fully one-half of hind width of second segment, latter not as long as usual, but broader in front at attachment, third segment scarcely broader than second. Pygidium about one and one-half times as long as broad, tip very broad, truncate, nearly as broad as the base, slightly broader in middle, surface minutely granulate, and with about ten large punctures. Much long white hair on underside of last three segments. Fore wings have the marginal cell a little narrowed toward tip, second submarginal with very short pedicel, third a little longer below than broad, outer side bent a little near end, not sinuous.

Length 7 mm.

One male from Patagonia, Arizona, 20 August (Bequaert). Type M.C.Z. no. 27621.

Cerceris minax Mickel

Mickel, Nebr. Univ. Studies, XVII: 339, 1917.

I have a paratype from Auburn, Calif.; also described from Sacramento.

Cerceris hesperina Bks.

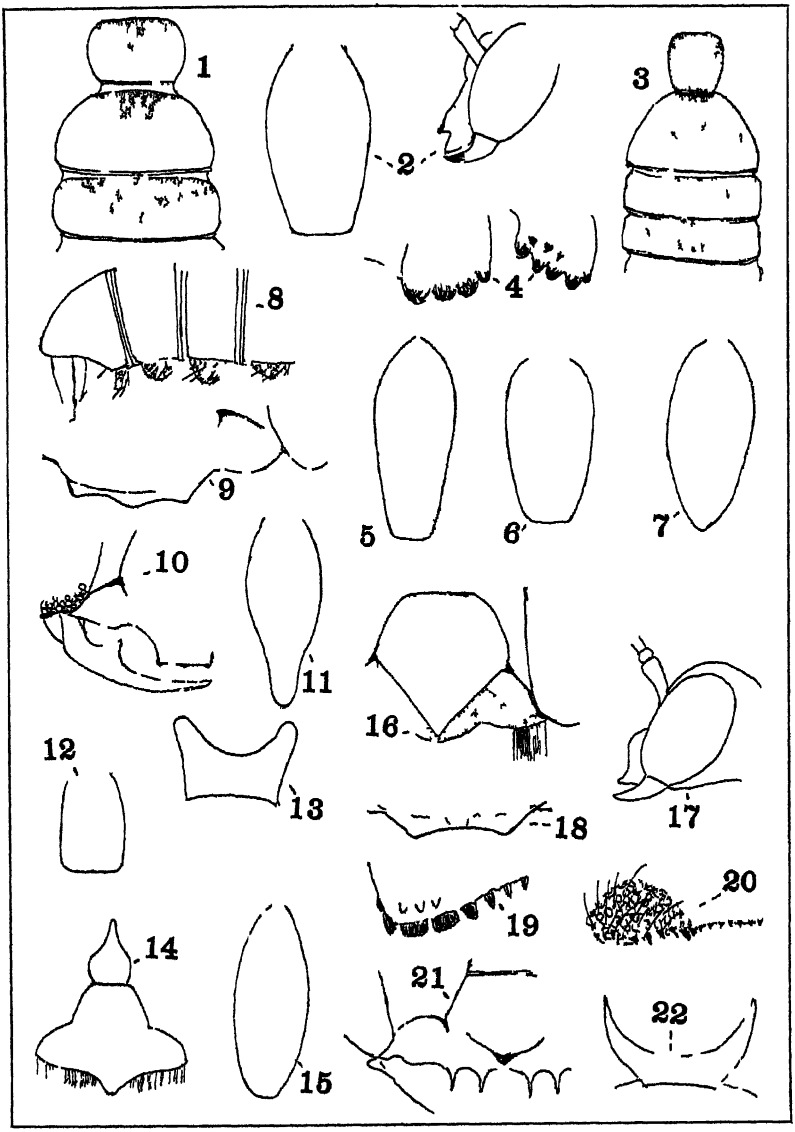
Banks, Bull. Mus. Comp. Zool., LXI: 115, 1917.

Specimens from Ainsworth, 20 July and Yakima City, 2 July, both Wash. (Henshaw).

C. pudorosa Mickel (Nebr. Univ. Studies, XVII: 338, 1917) appears to be a synonym; *hesperina* has several months priority.

Explanation of Plate 1

Fig. 1. *Cerceris athene*, base of abdomen.
Fig. 2. *Cerceris athene*, pygidium, side of head.
Fig. 3. *Cerceris completa*, base of abdomen.
Fig. 4. *Cerceris illota*, teeth on lobe of sixth ventrite.
Fig. 5. *Cerceris arno*, pygidium.
Fig. 6. *Cerceris vierecki*, pygidium.
Fig. 7. *Cerceris snowi*, pygidium.
Fig. 8. *Cerceris calodera*, side-view of abdomen.
Fig. 9. *Cerceris illota*, clypeus.
Fig. 10. *Cerceris isolde*, clypeus.
Fig. 11. *Cerceris convergens*, pygidium.
Fig. 12. *Cerceris æqualis*, pygidium.
Fig. 13. *Cerceris eurymele*, clypeal process from above.
Fig. 14. *Cerceris thione*, clypeus from in front.
Fig. 15. *Cerceris melanthe*, pygidium.
Fig. 16. *Cerceris femur-rubrum*, clypeus of male.
Fig. 17. *Cerceris complanata*, head from side.
Fig. 18. *Cerceris populorum*, edge of clypeus.
Fig. 19. *Cerceris populorum*, teeth on lobe of sixth ventrite
Fig. 20. *Cerceris illota*, lobe of fifth ventrite.
Fig. 21. *Cerceris athene*, clypeus.
Fig. 22. *Cerceris sextoides*, clypeal process from above.



BANKS—CERCERIDÆ

NEW SPECIES OF DIPLOSPHYRONID PSEUDOSCORPIONS FROM AUSTRALIA[1]

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Through the kindness of Professor Nathan Banks, the writer has been able to study the collections of Australian and New Zealand pseudoscorpions deposited in the Museum of Comparative Zoölogy. The majority of these collections were taken by members of the Harvard Australian Expedition in 1931 and 1932.

The present paper is concerned only with the diplosphyronid pseudoscorpions. The specimens have been mounted on microscope slides after being cleared in beechwood creosote. Measurements were made with a calibrated micrometer ocular and are expressed in millimeters. All of the specimens described here have been returned to the Museum of Comparative Zoölogy.

Family OLPIIDÆ Chamberlin 1930

Subfamily Olpiinæ Banks 1895

Genus *Olpium* L. Koch 1873

Olpium zealandiensis sp. nov.

Figures 1–3

Female. Body moderately slender; carapace moderately brown, abdomen and legs light yellowish brown, palpi deep reddish brown. Length of body 2.7 mm. *Carapace* smooth except weakly developed netlike lines on the posterior one-third of the face and along the sides. Setæ sparse, only two setæ along the posterior margin of the carapace. The two eyes of each side separated by less than the diameter of the posterior eye. Lateral margins of the carapace weakly convex, posterior margin nearly straight. Length of carapace about 0.8 mm., greatest width across posterior margin and equal to 0.71 mm., ocular width about 0.5 mm.

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[1] Published by a grant from the Museum of Comparative Zoölogy at Harvard College.

Abdomen elongate with sides weakly and evenly convex, length 1.9 mm., width 1.05 mm. All *tergites* equally sclerotic, not divided, surface marked by very faint netlike sculpturing. Each of the first two tergites with four setæ, more posterior tergites with six setæ, the tenth and the eleventh with 10 setæ. *Sternites* a little more lightly pigmented than the tergites and virtually unsculptured. Most sternites with six to 10 very fine acuminate setæ; sternites not divided.

Chelicera fairly stout, 0.27 mm. long, width of base 0.16 mm. Flagellum of three setæ, anterior one stout and denticulate along the distal one-third; the middle seta about two-thirds the length of the distal one and also subterminally denticulate; the proximal seta inconspicuous, less than one-half the length of the middle one, and apparently acuminate. *Fixed finger* gently curved, with four or five small, retroconical teeth along the distal one-half of the inner margin; lamina exterior wide and conspicuous; distal tooth of serrula interior ligulate and with finely serrate margin, next three more proximal teeth platyform and with serrate margins, other teeth modified to form a velum. *Movable cheliceral finger* a little curved, fairly slender; serrula exterior of 20 ligulate plates; subapical lobe stout and with two rounded cusps; apical tooth no more sclerotic than the rest of the finger; galeal seta inserted near the base of the subapical lobe and not reaching to the tip of the galea; galea (Fig. 1) stout, straight, and with three fairly stout and little-curved terminal and subterminal rami; length of movable finger 0.2 mm.

Palps (Fig. 2) moderately stout; polished reddish brown in color; investing setæ long, acuminate, and fairly numerous; surface smooth except for weakly developed granules on the sides of the maxillæ, on the trochanteral protuberances, on the central portion of the flexor surface of the femur, and along the distal half of the flexor surface of the chelal hand. Maxilla 0.44 mm. long, 0.28 mm. wide; trochanter 0.40 mm. long, 0.24 mm. wide; femur 0.71 mm. long, width 0.26 mm.; tibia 0.71 mm. long, 0.31 mm. wide; chela without pedicle 1.16 mm. long, 0.44 mm. wide; chelal hand without pedicle 0.60 mm. long, 0.42 mm. deep. From the side, chelal hand (Fig. 3) stout, depth little less than the width; hand not much narrowed towards the fingers; length of movable finger 0.62 mm. Many marginal teeth of chelal fingers broken but apparently about 45 conical and cuspid teeth distributed along nearly the entire margin of each finger.

Legs moderately stout, yellow in color; setæ fine and acuminate, sparse on the proximal podomeres but longer and more numerous on the distal podomeres; surfaces of pedal podomeres apparently unsculptured; tarsal claws stout. *First leg* with pars basalis deepest across the distal end, length measured along the extensor margin 0.264 mm., depth 0.13 mm.; pars tibialis stout, extensor margin flatly convex, flexor margin more convex, length measured along the extensor margin 0.22 mm., depth 0.143 mm.; tibia subcylindrical except in the proximal portion, length 0.30 mm., depth 0.103 mm.; metatarsus subcylindrical, length 0.135 mm., depth 0.07 mm.; telotarsus a little deeper proximally than distally, length 0.133 mm., depth 0.067 mm. *Fourth leg* with extensor margin of femur a little flatly convex in the center, more convex near the ends; flexor margin of femur more weakly and evenly convex than the extensor margin; length of pars basalis 0.23 mm.; length of pars tibialis measured along the extensor margin 0.55 mm., depth 0.265 mm.; length of entire femur 0.67 mm.; tibia with extensor margin nearly straight except at the proximal end, flexor margin weakly convex, length 0.50 mm., depth 0.14 mm.; metatarsus subcylindrical, with a long tactile seta inserted very close to the proximal margin, length 0.20 mm., depth 0.095 mm.; telotarsus subcylindrical, length 0.17 mm., depth 0.078 mm.

Genital complex very simple; posterior operculum or third sternite with four setæ. One median and two lateral cribiform plates, all small and subequal in size.

Type locality. The female holotype collected by Mr. G. Archey on Tera Kihi Island, Hauraki Gulf, New Zealand, on October 25, 1924.

Remarks. A single species of *Olpium*, *O. michaelsoni* Tullgren, 1909, has been reported previously from the

Australian region. From the description given by Chamberlin (1930), it is evident that *zealandiensis* differs from *michaelsoni* by having much stouter palpal podomeres. By comparing the palp of *zealandiensis* with the figure given by Beier (1932, fig. 210) for the palp of *michaelsoni*, it may be seen that a number of slight differences exist between the two forms with respect to the shape of the palpal podomeres. *Olpium zealandiensis* may be readily separated from other species of the genus by characteristics of the palpal podomeres.

Genus *Xenolpium* Chamberlin 1930

Xenolpium granulosum sp. nov.

Figures 4–6

Female. Body elongate; length 4.65 mm. *Carapace* light brown in color; posterior margin nearly straight, anterior margin weakly bilobed, lateral margins very weakly convex to straight behind the eyes; posterior margin with two setæ, each placed some distance anterior to the actual margin; anterior margin with four setæ; eyes prominent; anterior eye separated from the anterior carapacal margin by more than the diameter of the eye, eyes of each pair separated by about one-half the diameter of the eye; carapace smooth except for netlike markings along the side and weakly developed granules behind the eyes; length of carapace 1.08 mm.; posterior and greatest width about 0.9 mm.; ocular width 0.5 mm. *Abdomen* much wider than carapace; lateral margins gently convex; length 3.55 mm., greatest width 1.9 mm. *Tergites* light brown in color, surface virtually smooth; first tergite with four setæ, central tergites with six to eight setæ; all tergites undivided. *Sternites* smooth, light brown in color; most sternites with eight, some with six or 10 marginal setæ.

Chelicera moderately deep brown in color; base fairly stout and marked by a few netlike lines on the exterior surface; all setæ long and acuminate; flagellum of four stout blades, each with an almost smooth margin; chelicera 0.29 mm. long, base 0.175 mm. wide. *Fixed finger* with wide and evenly convex lamina exterior; distal one-half of inner margin with five or six retroconical teeth, two other teeth in the inner margin of the apical tooth; terminal plate of serrula interior spinelike, the next three conical, others fused into a velum, all teeth with entire margins. *Movable finger* fairly stout, a little curved; subapical lobe much smaller than the apical tooth and located very close to the latter; serrula exterior of about 20 ligulate plates (exact count prevented by broken plates); galea (Fig. 4) trifid near base, each branch simple and fingerlike; galeal seta fairly stout and not reaching to the tip of the galea; movable finger 0.26 mm. long.

Palps (Fig. 5) moderately stout, deep reddish brown in color; setæ acuminate; surface of podomeres very weakly granular, with the granules minute and hardly discernible on the extensor surfaces of all podomeres except the trochanter; chelal fingers with surface smooth. Maxilla 0.54 mm. long, 0.38 mm. wide; trochanter with conical extensor protuberance and a more rounded subdorsal one, granules of the extensor side confined to the protuberances; length of trochanter 0.54 mm., width 0.31 mm.; femur 0.88 mm. long, 0.35 mm. wide; tibia 0.92 mm. long, with 0.37 mm. Chela from the dorsad with hand stout, fingers gently curved and well separated from the hand; chela without pedicle 1.58 mm. long, 0.55 mm. wide; chelal hand exclusive of the pedicle 0.85 mm. long, 0.49 mm. deep; movable finger 0.8 mm. long. From the side, chelal hand (Fig. 6) subcylindrical; basal margin rounded and blended into the dorsal and ventral margins without interruption; fingers fairly slender; each finger with about 60 marginal teeth distributed along almost the entire finger margin; teeth of the distal portion of each row retroconical and with well-developed cusps, those of the proximal end of each row rounded and acuspid.

The *legs* deep yellow in color; fairly stout; surface apparently not sculptured; setæ long and acuminate, more numerous on the distal than on the proximal podomeres; tarsal claws stout. *First leg* with femoral parts stout, margins of pars basalis flatly convex, margins of pars tibialis more rounded; length of pars basalis measured along the extensor margin 0.285 mm., depth 0.185 mm.;

pars tibialis measured along the extensor margin 0.30 mm. long, 0.182 mm. deep; tibia with extensor margin nearly straight except at the proximal end, weakly convex on the flexor margin, pedicle not developed, length 0.375 mm., depth 0.118 mm.; metatarsus subcylindrical but a little narrowed distally, length 0.16 mm., depth 0.083 mm.; telotarsus like the metatarsus in shape but somewhat more slender, length 0.16 mm., depth 0.067 mm. *Fourth leg* with subtriangular pars basalis, length 0.315 mm., depth 0.20 mm.; flexor margin of pars tibialis almost straight, extensor margin flatly convex with a distinct angulation near the basal end, length measured along the extensor margin 0.78 mm., depth 0.335 mm.; entire femur 0.93 mm. long; tibia and tarsal podomeres with shape much like the corresponding podomeres of the first leg; tibia 0.62 mm. long, 0.175 mm. deep; metatarsus 0.245 mm. long, 0.115 mm. deep; telotarsus 0.225 mm. long, 0.095 mm. deep; metatarsus with a tactile seta located on the extensor surface near the base of the podomere; telotarsus with two tactile setæ, one located 0.045 mm. and the other 0.125 mm. from the proximal margin.

Genital complex very simple. Second sternite or anterior operculum with 11 small marginal setæ; third sternite or posterior operculum with five marginal setæ. Small median and lateral cribiform plates present.

Type locality. The female holotype from Mullewa, Western Australia. Collection made by Dr. W. M. Wheeler on September 20, 1931.

Remarks. *Xenolpium granulosum* appears closely related to *O. amboinensis* Chamberlin, 1930, from the Dutch West Indies. The two species differ by the more slender chela, the basally less truncate chelal hand, and the larger size of the body in *O. granulosum.*

Family GARYPIDÆ Hansen 1894

Subfamily GARYPINÆ Simon 1879

Genus *Garypus* L. Koch 1873

Garypus longidigitus sp. nov.

Figures 7, 8

Female. Body large, stout, 4.4 mm. long; appendages long and slender. *Carapace* light brown in color; surface granular and marked by netlike lines; anterior margin bilobed, lateral margins weakly convex; eyes large, the eyes of one side separated by less than one ocular diameter; eyes removed from the anterior carapacal margin by between two and three ocular diameters; transverse furrows weakly developed; setæ scattered, fairly numerous; length of carapace 1.28 mm., greatest width posteriorly and equal to 1.1 mm., ocular width 0.7 mm. *Abdomen* oval-elongate, length 3.1 mm., width about 1.9 mm. *Tergites* 2 to 10 divided; surface sculptured as on the carapace; brown in color; setæ weak and short; first tergite with 10 setæ, half-tergites of central and posterior part of body with six or seven setæ along the posterior margin and two or three setæ along the lateral margin; intertergal membranes and median membranes between half-tergites continuous, wide, and marked by wavy striations. *Sternites* 4 to 10 divided; very lightly pigmented, especially anteriorly; sculpturing scalelike or netlike and much more weakly developed than on the tergites; setæ short, fine, more or less similar in number and arrangement to those of the tergites; intersternal membranes like those of the tergites. *Pleural membranes* wide, marked by rugose or papillose striations. Stigmata placed entirely in the pleural membranes and not on the sclerotic sternal halves.

Chelicera fairly sout, yellowish brown in color; length 0.36 mm., width of base about 0.215 mm. Base quadrate; inner margin with a deep sinuation between the base and the fixed finger; setæ *is*, *ls*, and *sb* located on the promixal half of the fixed finger; dorsal surface of base weakly sculptured by netlike lines. *Flagellum* with three stout and much flattened blades; the posterior blade two-thirds as long as the anterior one, the central blade intermediate in length; each blade denticulate, with the teeth long, slender, irregular in distribution and length, and confined to the distal two-thirds of each blade. *Fixed finger* very convex, with well-rounded lamina exterior; apical tooth very dark brown and sclerotic, with two small denticles on the inner surface; inner margin of finger with one or two stout, sclerotic, retroconical distal teeth followed proximally by three to five weaker, non-sclerotic, retroconical teeth becoming progressively smaller in size; distal plate of serrula interior spinelike and directed anteriorly. *Movable finger* gently curved; apical tooth acute, darkly pigmented, and sclerotic; subapical lobe subdivided distally into two acute teeth; galeal seta inserted at the level of the subapical lobe and not reaching to the tip of the galea; serrula exterior partly broken but probably composed of about 25 ligulate plates; galea stout, fairly straight, with six slender and gently curved simple rami confined to the distal one-third; length of movable cheliceral finger about 0.31 mm.

Palps (Fig. 7) slender; yellowish brown except chela reddish brown; surface of podomeres except the chelal fingers marked by netlike lines and granulations; setæ fairly numerous, short, acute, slightly curved, and inconspicuous. Maxilla 0.78 mm. long, about 0.5 mm. wide; trochanter 0.65 mm. long, 0.38 mm. wide; femur 1.65 mm. long, 0.318 mm. wide; tibia 1.38 mm. long, 0.35 mm. wide; chela without pedicle 2.65 mm. long, 0.65 mm. wide; depth of chela 0.59 mm., length of hand without pedicle 1.1 mm.; length of movable finger 1.65 mm. Shape of chela from the side and the arrangement of tactile setæ as shown in figure 8. Marginal teeth of chelal fingers cuspid, arranged along the entire finger margin; about 85 teeth on the fixed finger, about 70 teeth on the movable finger; teeth near each end of the row on each finger more or less conical, those of the center of the row on the fixed finger retroconical, those of the center of the row of the movable finger retroconical to much flattened so that they are much less acute than the opposing teeth of the fixed finger.

Legs very slender; deep yellow in color; surface marked by netlike lines; setæ like those of the palpi, except longer and more numerous on the flexor surfaces of the tibial and tarsal podomeres. *First leg* with stout trochanter, 0.33 mm. long, 0.235 mm. deep; pars basalis slender, flexor margin nearly straight, extensor margin convex in the center, podomere deepest near the distal end, length measured along the extensor margin 0.62 mm., depth 0.185 mm.; pars tibialis subcylindrical, length measured along the extensor margin 0.39 mm., depth 0.18 mm.; tibia with extensor margin convex, flexor margin concave, deepest at the distal end, length 0.57 mm., depth 0.135 mm.; metatarsus subcylindrical in shape, length 0.38 mm., depth 0.105 mm.; telotarsus 0.345 mm. long, 0.1 mm. deep. *Fourth leg* with trochanter 0.55 mm. long, 0.24 mm. deep; pars basalis subtriangular in outline, 0.395 mm. long, 0.215 mm. deep; pars tibialis with very weakly convex flexor margin continuous with the margin of the pars basalis, extensor margin weakly to flatly convex but a little more convex basally than distally, length measured along the extensor margin 0.995 mm., depth 0.275 mm.; entire femur 1.25 mm. long; tibia shaped as in the first leg but much more slender, length 0.98 mm., depth 0.15 mm.; metatarsus subcylindrical but a little narrower across the distal than the proximal end, length 0.48 mm., depth 0.13 mm.; telotarsus 0.38 mm. long, 0.12 mm. deep.

Genital complex simple; anterior operculum with 17 setæ, many of which are arranged in a row along the posterior margin; posterior operculum or third sternite with eight setæ forming a single row; lateral cribiform plates smaller than the somewhat fragmented median plate.

Type locality. Weier, Murray Islands, Torres Strait, Queensland. Collection made by H. L. Clark on October 4, 1913. Unfortunately, no ecological data accompany the single individual (holotype) in the collection.

Remarks. This is the first record of the genus *Garypus* L. Koch from the Australian region and its occurrence fulfills a prophecy made by Chamberlin (1934) that the genus should be present in Oceania.

Garypus longidigitus is readily separated from other species of the genus by the characteristics, especially the length : width ratios, of the palpal prodomeres. The very long and slender chelal fingers are among the most significant of the diagnostic features.

Genus *Synsphyronus* Chamberlin 1930

Synsphyronus + *Maorigarypus* Chamberlin, 1930, Ann. and Mag. Nat. Hist., ser. 10, 5: 616, 617.

Synsphyronus+*Maorigarypus* Chamberlin, 1931, Stanford Univ. Publ., Univ. Ser., Biol. Sci., 7(1): 135, 153, 155, 208, 215, 228 (figs.).

Synsphyronus Chamberlin + *Synsphyronidæ* Beier + *Maorigarypus* Chamberlin, Beier, 1932, Das Tierreich, 57: 226, 238.

Synsphyronus emend., Chamberlin, 1943, Ann. Ent. Soc. Amer., 36: 488, 489.

Genus emendatus. On studying in detail the new species described below, it becomes obvious that the species belong to the genus *Synsphyronus* in spite of the presence of seven, instead of eight or nine, tactile setæ on the fixed finger of the palpal chela. Since Chamberlin (1943) has shown that the variable number of tactile setæ is not a useful diagnostic character in this genus, there is no justification for the erection of a new genus. As a result, the genus *Synsphyronus* is hereby emended to include forms that have seven to nine tactile setæ on the fixed chelal finger.

The presence of seven setæ on the fixed chelal finger indicates relationship to the genus *Anagarypus* Chamberlin, 1930. However, the nature of the vestitural setæ of the palps and the position of tactile seta *est* of the fixed chelal finger preclude assignment of the present three species to the genus *Anagarypus.*

Synsphyronus (Maorigarypus) niger sp. nov.

Figures 9, 10

Male. Body, legs, and cheliceræ brown in color; palpi dark reddish brown; sculpturing of body and appendages as in the genus; length of body 3.6 mm. *Carapace* as in the genus; eyes of each side separated by about the lesser diameter of the anterior eye; carapacal furrows not evident; posterior margin with four setæ; length of carapace 1 mm., greatest width across the posterior margin and equal to 1.1 mm., ocular width about 0.6 mm. *Tergite* 1 with six setæ; each half of tergite 2 and tergite 3 with three setæ, more posterior tergites with four or five setæ on each half; tergal setæ subclavate to clavate. *Sternites* with setæ acuminate to terminally truncate; setæ similar to those of the tergites in number and arrangement; contral sternites not divided, anterior and posterior ones divided. *Abdomen* stout, 2.6 mm. long, about 1.85 mm. wide.

Chelicera with chætotaxy and flagellum as in the genus; length of chelicera 0.25 mm., width of base about 0.16 mm. Inner margin of fixed finger with three or four retroconical teeth, inner margin of apical tooth of fixed finger with two small denticles. *Movable cheliceral finger* a little curved; subapical lobe very near the base of the apical tooth; serrula exterior of 18 ligulate plates; galea relatively short, simple, stout, terminally rounded and without rami; length of movable finger 0.19 mm.

Palps (Fig. 9) very similar in outline to those of other species of the genus. Setæ of maxilla chiefly acuminate; setæ of the trochanter, femur, and tibia distinctly clavate; setæ of the chelal hand subclavate to clavate; setæ of the fingers acuminate and relatively long. Maxilla 0.60 mm. long, 0.34 mm. wide; trochanter nearly square in outline with the pedicle short and stout, length including pedicle 0.47 mm., greatest width taken at about a right angle with the longitudinal axis 0.37 mm.; femur 1.07 mm. long, width 0.30 mm.; tibia 0.81 mm. long, 0.325 mm. wide; chela basally truncate and little convex, fingers very slender in relation to the hand and gently curved; length of chela without pedicle 1.52 mm., width 0.44 mm.; length of hand without pedicle 0.83 mm., depth of chelal hand 0.36 mm.; length of movable finger 0.70 mm. *Marginal teeth* of the chelal fingers conical to retroconical in the distal part of the row of each finger, much flattened in the proximal portion of each row; cusps poorly developed; about 35 teeth on the movable finger, about 45 on the fixed finger. *Tactile setæ* arranged as shown in figure 10.

Legs dark brown in color, with the more distal podomeres somewhat dusky; setæ of femoral parts and the extensor margins of the more distal podomeres clavate, being conspicuously long and club-shaped on the tarsal podomeres of the fourth leg; setæ of the flexor surface of the tibial and tarsal podomeres acuminate; tarsal claws moderately stout. *First leg* with trochanter 0.245 mm. long, 0.175 mm. deep; pars basalis with flexor margin more or less evenly convex, 0.253 mm. long, 0.163 mm.

deep; pars tibialis with evenly convex extensor margin, flexor margin bulging near the center; length 0.285 mm., depth 0.19 mm.; tibia as in other species of the genus, length 0.335 mm., depth 0.125 mm.; metatarsus subcylindrical, length 0.158 mm., depth 0.095 mm.; telotarsus with both margins a little convex, length 0.145 mm., depth 0.075 mm. *Fourth leg* with extensor margin of the trochanter evenly convex, length 0.365 mm., depth 0.17 mm.; pars basalis subtriangular in shape, 0.265 mm. long, 0.19 mm. deep; pars tibialis with extensor margin more or less evenly but not strongly convex, flexor margin nearly straight and continuous with the flexor margin of the pars basalis, greatest length 0.61 mm., depth 0.245 mm.; entire femur 0.80 mm. long; tibia very weakly S-shaped, length 0.49 mm., greatest depth in the distal half and equal to 0.14 mm.; metatarsus subcylindrical, 0.195 mm. long, 0.102 mm. deep; telotarsus stout, length 0.19 mm., depth 0.10 mm.

Genital complex with the anterior operculum asetaceous except for six small acuminate setæ just anterior to the genital pore; posterior operculum with seven or eight small setæ approximate to the genital pore and five longer setæ along the posterior margin. Both opercula with numerous slitlike lyrifissures.

Type locality. The single male, the holotype, collected by Dr. P. J. Darlington on November 30, 1931, at Adelaide, South Australia.

Remarks. The present species differs from all previously described species of the subgenus *Maorigarypus* by having two rather than one or three tactile setæ on the movable chelal finger and differs from all described species of the genus *Synsphyronus* by having only seven tactile setæ on the fixed chelal finger. *Synsphyronus niger* is similar in these characters to *S. magnus* described below. Methods of separating these two species will be given under the description of the latter.

Synsphyronus (Maorigarypus) magnus sp. nov.

Figures 11, 12

Female. Very large; body ovate in general shape; abdomen, carapace, and legs light to medium brown; palpi deep reddish brown; sculpturing as typical in members of the genus; body 4.45 mm. long. *Carapace* as in the genus; anterior eye of each side narrowly elliptical and separated from the posterior eye by about twice the lesser diameter of the anterior eye; a heavily sclerotized keel or ridge between the eyes, reaching its greatest development at the anterior border of the posterior eye; anterior eye removed from the anterior carapacal margin by a distance equal to four or five times the diameter of the posterior eye; lateral margins of carapace gently and evenly convex; posterior margin with six marginal setæ; length of carapace 1.35 mm.; greatest width along the posterior margin and equal to 1.5 mm.; ocular breadth about 0.8 mm. *Tergites* 2 through 10 divided; tergites 4 through 10 with each tergal half marked by a centrally located and more deeply pigmented spot; setæ subclavate, terminally truncate but not much widened; tergites 1 and 2 with eight setæ; other tergites with 10 to 16 setæ. *Sternites* 5 through 10 marked by pigmented spots similar to those of the tergites; division of some sternites weakly indicated; sternite 4 with eight marginal setæ; setæ of other sternites ranging from 10 to 14; setæ of anterior sternites acuminate, some setæ of posterior sternites weakly subclavate. *Abdomen* stout; 3.1 mm. long, about 2.5 mm. wide.

Chelicera as usual in members of the genus; longest blade of flagellum with three or four slender and long dentations placed a little distal to the midpoint; length of chelicera between 0.35 and 0.36 mm., width of base 0.21–0.22 mm.; length of movable finger about 0.26 mm. *Fixed finger* with relatively narrow lamina exterior; four retroconical teeth on the distal half of the inner finger margin, two smaller denticles on the inner margin of the apical tooth. *Movable finger* little curved; subapical lobe poorly developed, located approximate to the apical tooth; apical tooth little sclerotic; galea gently curved, simple, stout, terminally rounded and blunt, with conspicuous gland ducts passing from the base to the tip; serrula exterior of 19 ligulate plates; galeal seta not reaching nearly to the tip of the galea.

Palps (Fig. 11) with sculpturing and general shape of podomeres as usual in members of the genus; setæ of the maxillæ weakly subclavate like those of the tergites; setæ of all other podomeres of the palp, including both margins of the chelal hand, short, stout, clavate, and fairly numerous; setæ of the chelal fingers acuminate. Maxilla 0.81 mm. long, 0.46 mm. wide; trochanter including pedicle 0.67 mm. long, greatest width measured at about a right angle to the longitudinal axis 0.51 mm.; femur 1.50 mm. long, 0.39 mm. wide; tibia 1.17 mm. long, 0.42 mm. wide; length of chela without pedicle 2.05 mm., width 0.63 mm.; length of hand without pedicle 1.16 mm., depth 0.53 mm.; length of movable fingers 0.97 mm. Marginal teeth of chelal fingers weakly retroconical and strongly cusped in the distal part of the row, but flattened and acuspid in the proximal portion of the row of each finger; about 40 teeth on the movable finger and about 45 on the fixed finger. Movable finger with two tactile setæ, the fixed finger with seven, distributed as shown in figure 12.

Legs as typical in the subgenus *Maorigarypus;* anterior legs stout, posterior legs relatively slender; yellowish brown in color; tarsal claws moderately stout; setæ of the femur and the extensor margins of the tibial and tarsal podomeres short and subclavate to clavate, setæ of the flexor margins of the tibial and tarsal podomeres acuminate and relatively long. *First leg* with flexor margin of trochanter evenly covex, 0.35 mm. long, 0.25 mm. deep; pars basalis with both extensor and flexor margins weakly convex, the flexor flatly so, length measured along the extensor margin 0.35 mm., depth 0.24 mm.; pars tibialis subfusiform, length 0.40 mm., depth 0.27 mm.; tibia stout, the extensor margin weakly concave except in the proximal one-fourth, flexor margin convex, length 0.50 mm., depth 0.175 mm.; tarsal podomeres subcylindrical; metatarsus 0.21 mm. long, 0.13 mm. deep; telotarsus 0.225 mm. long, depth 0.11 mm. *Fourth leg* with extensor margin of trochanter highly arched or covex, flexor margin weakly but evenly convex, length 0.52 mm., depth 0.265 mm.; pars basalis subtriangular, 0.355 mm. long, 0.23 mm. deep; pars tibialis with extensor margin flatly convex, flexor margin weakly concave and continuous with that of the pars basalis; length of pars tibialis measured along the extensor side 0.91 mm., depth 0.28 mm.; entire femur 1.16 mm. in length; tibia weakly S-shaped, length 0.75 mm., depth 0.18 mm.; both tarsal podomeres subcylindrical; length of metatarsus 0.275 mm., depth 0.135 mm.; telotarsus 0.28 mm. long, depth 0.13 mm.

Genital complex simple, opercula little differentiated; anterior operculum with eight setæ, chiefly along the medial portion of the posterior margin; posterior operculum with nine marginal setæ; cribiform plates relatively large; two median plates with one located anterior to the other, the posterior one the smaller; lateral plates subequal in size to the larger of the median plates.

Type locality. A single specimen, the female holotype, in a collection taken by Dr. P. J. Darlington in November, 1931, on the Margaret River, Western Australia.

Remarks. The present species may be separated from other members of the subgenus *Maorigarypus*, except *S. niger*, by the reduced number of tactile setæ on the fixed chelal finger and by the presence of two tactile setæ on the movable finger. From *S. niger*, *S. magnus* may be separated by the larger size of the body and appendicular podomeres, differences in shape of the palpal tibia, and differences in the nature of the carapacal eyes and the teeth of the chelal fingers, as well as other specifically significant characteristics.

Synsphyronus (Synsphyronus) callus sp. nov.
Figures 13–15

Female. Description based on two individuals, the holotype and one female paratype. Measurements of the paratype are given in parentheses immediately after the corresponding measurements for the holotype whenever the two show significant difference. Body ovate; body, carapace, and legs light to moderately brown; palps deeper brown in color; sculpturing as typical in members of the genus; anterior legs somewhat stout, posterior legs relatively more slender; body 3.3 (3.25) mm. long. *Carapace* as usual in the genus; eyes of each side separated by about the diameter of the anterior eye, a sclerotic keel or ridge just anterior to the posterior eye; anterior eye of each side more or less circular in outline, posterior eye a little elliptical; four setæ along the posterior margin of the carapace; carapace 0.9 (0.95) mm. long, 0.1 mm. wide; ocular breadth about 0.55 mm. *Tergites* except the first divided; tergites 1 and 2 with four setæ, greatest number of setæ on any tergite is eight; all setæ subclavate; tergites 4 through 10 with a pigmented spot on each half-tergite. *Sternites* 4 and 5 nearly entire, sternites 6 through 10 divided; sternites 5 through 10 with darkly pigmented spots much as on the tergites; most sternites with six setæ, a few with eight setæ; setæ of anterior sternites usually acuminate, those of posterior sternites weakly subclavate. *Abdomen* oval in general shape, length about 2.4 mm., breadth about 1.9 mm.

Chelicera as usual in the genus; flagellum with the two short blades little more than one-fourth as long as the longest blade; the longest flagellar blade with one to three slender denticles near the center of the anterior margin; length of the chelicera about 0.23 mm., width of base 0.15 to 0.16 mm.; movable finger 0.165 (0.185) mm. long. *Fixed cheliceral finger* with three retroconical teeth on the distal half of the inner margin; inner margin of the apical tooth nearly edentate; apical tooth stout, terminally blunt; lamina exterior narrow. *Movable cheliceral finger* little curved, outer margin nearly straight; subapical lobe blunt, not well developed, approximate to the apical tooth in position; serrula exterior of 19 to 21 ligulate plates (condition and position of specimens preclude exact count); galea broken in all specimens, but evidently stout.

Palps (Fig. 13) with setæ of maxilla acuminate to subclavate; setæ of chelal fingers acuminate; all other palpal setæ clavate and relatively long; podomeres with the usual pseudoderm and sculpturing. Maxilla 0.47 (0.49) mm. long, 0.30 mm. wide; trochanter 0.42 mm. long, width at right angles to greatest length 0.34 (0.33) mm., width across the distal end 0.27 mm.; femur 0.98 mm. in length, 0.245 (0.25) mm. in width; tibia with length 0.73 (0.74) mm., width 0.27 (0.28) mm.; length of chela without pedicle 1.38 (1.43) mm., width 0.39 (0.375) mm.; chelal hand without pedicle 0.68 (0.7) mm. long, 0.33 mm. deep; movable finger 0.7 (0.75) mm. in length. Chelal teeth retroconical and cuspid at the distal end of the row of each finger, conical to rounded and acuspid at the proximal end of the row; fixed finger with 45 to 50 teeth, movable finger with about 35 teeth. Movable finger with one tactile seta, fixed finger with seven; setæ distributed as indicated in figure 14.

Legs as in the subgenus *Synsphyronus* except that the tarsus of one or more legs may have a suture dividing the tarsus into two parts, which, however, are never articulate; incompletely fused metatarsus and telotarsus may occur on the same animal as has some of the tarsal podomeres completely fused; tarsal claws stout; pedal chætotaxy much as in *S. niger* described above. *First leg* fairly stout; trochanter 0.235 mm. long, 0.16 mm. deep; pars basalis with extensor margin nearly straight, flexor margin weakly convex, length 0.26 mm., depth 0.135 mm.; pars tibialis with extensor margin nearly straight except near the proximal end in the holotype but somewhat evenly convex in the paratype, flexor margin moderately convex, length 0.25 mm., depth 0.16 mm.; tibia with extensor margin nearly straight, length 0.31 mm., depth 0.105 mm.; miotarsus (fused metatarsus and telotarsus) 0.285 (0.305) mm. long, 0.08 mm. deep. *Fourth leg* relatively slender; trochanter about 0.34 mm. long (broken in holotype and length not determined), 0.16 (0.17) mm. deep; pars basalis with a slight protuberance at the distal end of the nearly straight flexor margin, 0.275 mm. long, 0.16 mm. deep; pars tibialis with extensor margin a little flatly convex except at the ends, flexor margin nearly straight, length 0.55 (0.54) mm., depth 0.19 (0.185) mm.; entire femur 0.75 (0.74) mm. long; tibia weakly S-shaped, length 0.52 mm., depth 0.115 (0.11) mm.; miotarsus subcylindrical or a little fusiform, 0.38 (0.39) mm. long, 0.095 (0.09) mm. deep.

Genital complex simple, anterior operculum with six setæ, posterior operculum with six (paratype) or eight (holotype) setæ; two median cribiform plates, arranged one behind the other and with two or three very small accessory plates between; lateral plates subequal to or smaller than the anterior median plate.

Tritonymph. A single nymph, probably a tritonymph. Similar to the adult in general appearance and many details; appendages stouter and, especially the palpi, a little lighter in color; body 2.4 mm. long. *Carapace* 0.73 mm. long, 0.89 mm. wide across the posterior margin, ocular breadth about 0.45 mm. *Chelicera* much as in the adult; galea (Fig. 15) bifurcated at the very tip; serrula exterior of 16 plates. *Palpi* in general as in the adult, except podomeres somewhat smaller and stouter; femur 0.73 mm. long, 0.195 mm. wide; tibia 0.53 mm. long, 0.23 mm. wide; chela including pedicle 1.02 mm. in length, 0.30 mm. in width; length of hand including pedicle 0.53 mm.; movable finger 0.52 mm. long. Movable chelal finger with about 25 marginal teeth; one tactile seta, probably *t*, located somewhat distal to the midpoint of the finger. Fixed chelal finger with about 35 marginal teeth; six tactile setæ present and distributed as follows: *et* about one-third of the finger length from the tip; *it* on a level about one areolar diameter proximal to *et*; *est* located a little distal to the basal one-third of the finger; *ist* (?) and *ib* situated a little more than one-fifth of the finger length from the base of the finger and separated by less than one areolar diameter; a single exterior seta (probably *eb*) located near the base of the finger and considerably proximal to the level of *ib*. *Legs* similar to those of the adult but podomeres smaller and somewhat stouter.

Type locality. Australia. The female holotype from a collection taken on Rottnest Island, Western Australia, in December, 1931, by members of the Harvard Australian Expedition; the female paratype collected by Dr. P. J. Darlington at Cottesloe Beach, near Perth, Western Australia, on October 17, 1931; and the paratype nymph in a collection made by Dr. Darlington on October 24, 1931, at Rottnest Island, Western Australia.

Remarks. *Synsphyronus callus* is unique among members of the genus by having a combination of one tactile seta on the movable chelal finger and seven tactile setæ on the fixed chelal finger.

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EXPLANATION OF PLATES 2 AND 3

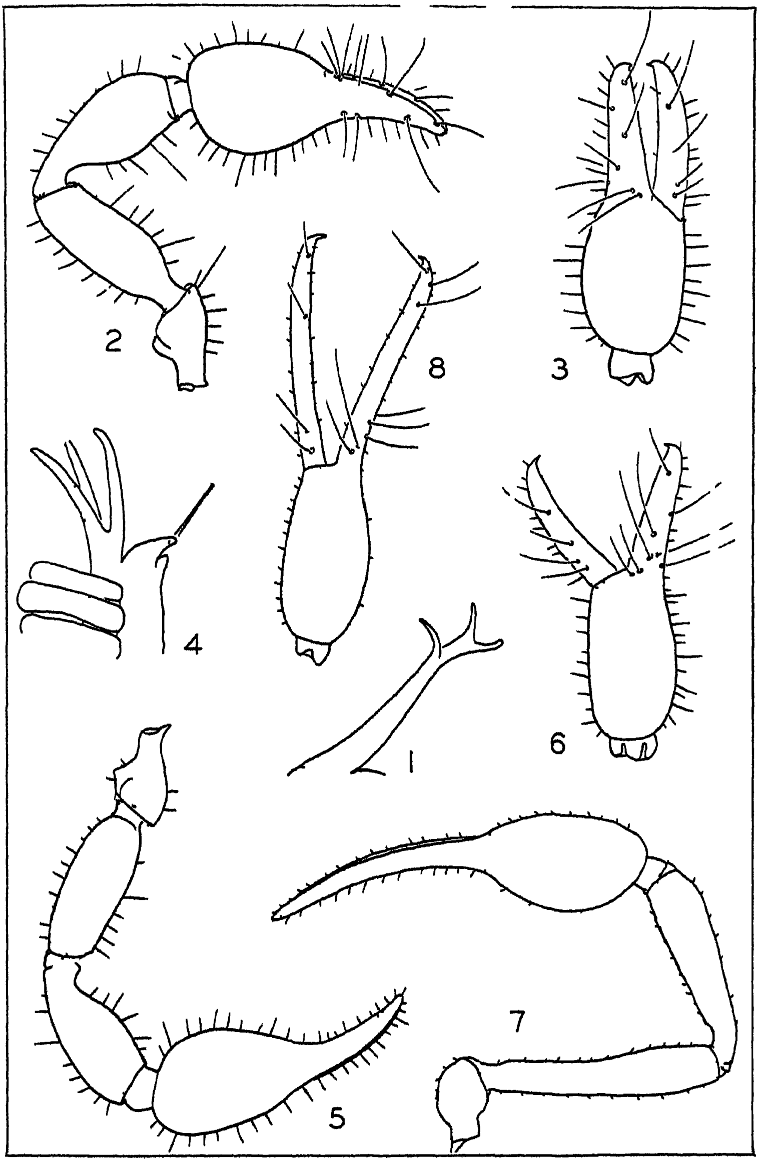
Drawings were made with the aid of a camera lucida. The tactile setæ are omitted from most of the dorsal views of the palpi and the marginal teeth are omitted from the exterior views of the chelæ.

PLATE 2

Fig. 1. *Olpium zealandiensis* sp. nov., galea, female holotype.
Fig. 2. *Olpium zealandiensis* sp. nov., dorsal view of palp, female holotype.
Fig. 3. *Olpium zealandiensis* sp. nov., exterior view of chela, female holotype.
Fig. 4. *Xenolpium granulosum* sp. nov., tip of movable cheliceral finger and galea, female holotype.
Fig. 5. *Xenolpium granulosum* sp. nov., dorsal view of palp, female holotype.
Fig. 6. *Xenolpium granulosum* sp. nov., exterior view of chela, female holotype.
Fig. 7. *Garypus longidigitus* sp. nov., dorsal view of palp, female holotype.
Fig. 8. *Garypus longidigitus* sp. nov., exterior view of chela, female holotype.

PLATE 3

Fig. 9. *Synsphyronus niger* sp. nov., dorsal view of palp, male holotype.
Fig. 10. *Synsphyronus niger* sp. nov., exterior view of chela, male holotype.
Fig. 11. *Synsphyronus magnus* sp. nov., dorsal view of palp, female holotype.
Fig. 12. *Synsphyronus magnus* sp. nov., exterior view of chela, female holotype.
Fig. 13. *Synsphyronus callus* sp. nov., dorsal view of palp, female holotype.
Fig. 14. *Synsphyronus callus* sp. nov., lateral view of chela, female holotype.
Fig. 15. *Synsphyronus callus* sp. nov., galea, nymphal paratype.



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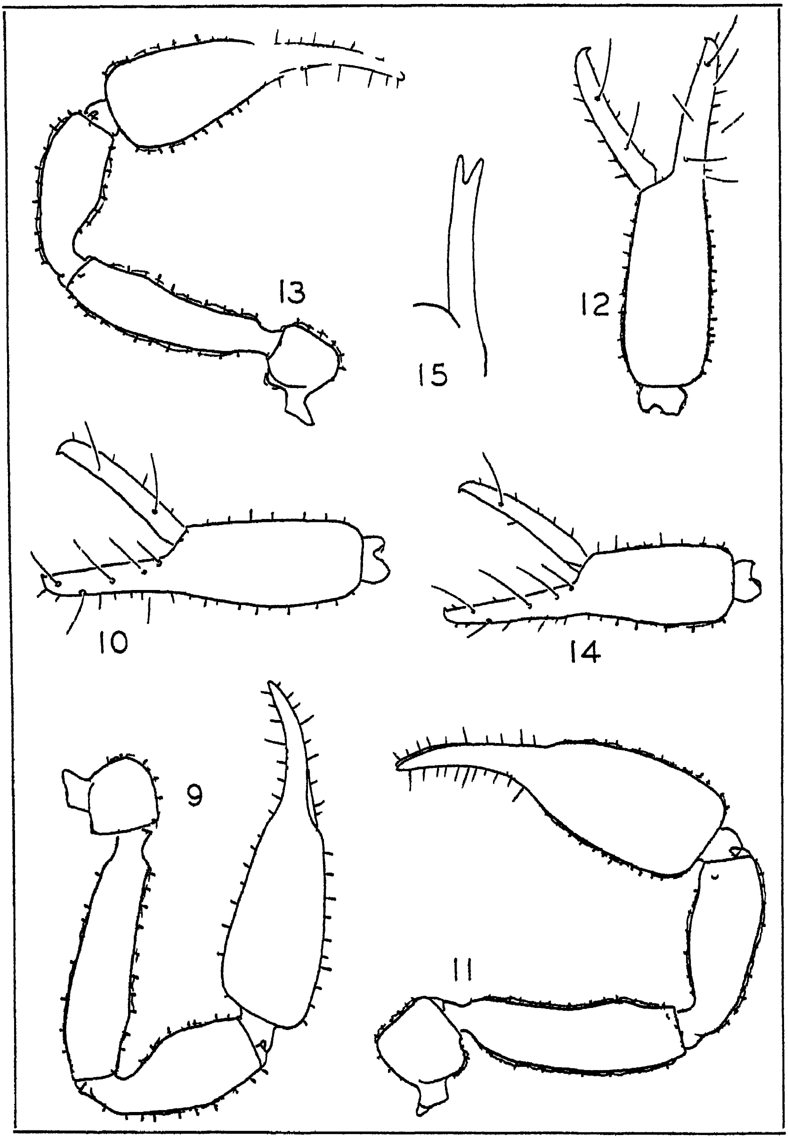
PSYCHE, 1947 VOL. 54 PLATE 3



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THE GENUS *CALLICTITA* (LEPIDOPTERA, LYCÆNIDÆ)[1]

By Robert G. Wind
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and
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In 1908 Bethune-Baker erected the genus *Callictita* for a single and very distinct new species, *cyara,* from the Angabunga River, British New Guinea. Eight years later Joicey and Talbot extended the range of this species by adding a new subspecies, *albiplaga,* from the Wandammen Mts. of Dutch New Guinea. Peculiarly, in Seitz' addenda to Volume 9 of the Macrolepidoptera of the World (1927) appears this same name *albiplaga,* but credited to Fruhstorfer, *i.l.*, with no mention of Joicey and Talbot whatsoever. Seitz figured the form, but gave no locality. His illustration looks suspiciously similar to that of Joicey and Talbot.

Fruhstorfer in Seitz (*loc. cit. infr.*) gives the following diagnosis of the genus: "Structure of the fore wings different from *Castalius* by the first subcostal immediately disappearing in the costal and crossing it. The subcostal fork is shorter, its branches more closely together than in *Castalius* or *Taraka.* Fore wing exhibits a roundish, large, discal black androconial area. Clasping organs highly specialized, œdeagus canaliculate as in *Upolampes.* Uncus remarkably feeble, short, narrow, but with very long apophysis. Valve trumpet-like, distally wide open, with a sharp dorsal tooth, everywhere extremely long-haired."

Callictita Bethune-Baker

Bethune-Baker, 1908, P.Z.S., 1908: 118. Genotype (by monotypy), *Callictita cyara* B.-B.

Fruhstorfer, 1923, [in] Seitz, Macrolep. World, 9: 891.

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[1] Published by a grant from the Museum of Comparative Zoölogy at Harvard College.

Apparently this genus is distributed from one end of New Guinea to the other, but only in the mountains.

Callictita cyara cyara Bethune-Baker

Callictita cyara Bethune-Baker, 1908, P.Z.S., 1908: 119, pl. 8, fig. 1; Fruhstorfer, 1923, [in] Seitz, Macrolep. World, 9: 891, pl. 145k.

Callictita albiplaga (*nec albiplaga* Joicey and Talbot): Jordan, 1930, Proc. Ent. Soc. London, 5: 60.

The species was described originally from the Angabunga River and Owgarra, in eastern New Guinea. Fruhstorfer (*loc. cit.*) records it as well from Mt. Gelu (1100 meters) in eastern New Guinea, and Jordan (*loc. cit.*) gives the Edie River, west side of the Herzog Mts., eastern New Guinea, April (?). In the Museum of Comparative Zoölogy is a series of 18 specimens from Mt. Misim (6000 feet), Morobe District, eastern New Guinea, taken Jan.–March, 1933, by Herbert Stevens.

Males above with the fore wing bright iridescent violet, with a central patch of jet black scales, and a narrow black outer marginal border. Hind wing is black-brown entirely, save for a central white patch, about the same size as the discal black patch of the fore wing.

Females above similar, save for: the slightly larger, somewhat less intense black discal patch of the fore wing above; the much broader outer marginal border, and the extension of this border in on the inner margin to the base, where it thickens up to the lower Dc. The hind wing is largely white, with a border of black-brown completely surrounding the wing, on costa, outer margin and inner margin, including the base. On the outer margin, near the anal angle, just outward of this band is a row of two or three white internervural dashes. A tail at Cu2.

Underside of male is white on both wings. The fore wing is crossed by four bands of black-brown, one on the margin, to 2A, one post-discal to Cu2, one discal to inner margin, and a basal one, covering the whole base, save for a costal dash of white. Hind wing has an irregular heavy dark band running from costa near base, across base, and along inner margin, frequently showing white within it (evidently remnants of white centering of spots). On the costa is a small triangular dark spot, reaching Rs, and rarely M1. Outer margin brown, with occasional marginal white spots, particularly in M3–Cu1. In Cu1–Cu2 is a jet-black marginal spot, ringed with metallic green, strongest basally, and rather weak outwardly, and in Cu2–2A is a jet-black dash, basally lined with a metallic green bar.

Females similar, but with the bar on the inner margin lacking the white, or almost lacking it. The costal triangular spot constantly reaches M1 instead of Rs.

Remarks. The male of the typical subspecies is apparently described here for the first time. Bethune-Baker erroneously sexed his specimens as males. Jordan (*loc. cit.*) evidently based his Edie River record of "*albiplaga* Fruhst." on males of this subspecies, though he failed to describe them.

Males of the three subspecies (*cyara, albiplaga*, and *arfakiana*) do not seem to differ on the upper surfaces, and only more material will tell whether the same is true of the females.

The real difference between the subspecies lies on the under surface. The pattern here varies consistently. From *albiplaga* the typical subspecies may be told by the more scalloped outer marginal border of the former, and the consequent increase in white outward of it. The band on the inner margin is in *albiplaga* more broken up into spots. In general, there appears to be a decrease in the amount of black in *albiplaga* in the hind wing below, but on the fore wing there is, if anything, an increase.

Typical *cyara* may be separated from *arfakiana* by the latter's smaller size, and the presence of two well-defined costal spots on the hind wing below, instead of one as in *cyara*. There is on this surface more metallic scaling in *arfakiana*, near the anal angle.

Callictita cyara albiplaga Joicey and Talbot

Callictita cyara albiplaga Joicey and Talbot, 1916, Ann. Mag. Nat. Hist., (8)17: 80, pl. 7, fig. 5.

Callictita cyara albiplaga Seitz, 1927, Macrolep. World, 9: 1114, pl. 147b.

Described from the Wandammen Mts. in Dutch New Guinea at an elevation of 3–4000 feet.

Differs from *cyara* in characters mentioned under that subspecies. From *arfakiana* it may be told by the more scalloped outer marginal border on the hind wing below, the defined spots on the inner margin and the single isolated spot on the costa (rather than two, as in *arfakiana*).

No specimens of this subspecies have been seen, but it is well described and illustrated, in color, by Joicey and Talbot.

Callictita cyara arfakiana, new subspecies

UPPERSIDE:

Male. Fore wing brilliant iridescent purple. Outer margin narrowly black-brown. A large central patch of jet-black raised scales. *Hind wing* black-brown with a central white patch. At Cu1–Cu2 in one specimen is a suggestion of a pale spot. A tail at Cu2.

UNDERSIDE:

Male. Fore wing white, crossed by four brown bands, one on the outer margin (with a faint streak of white outward of it), one post-discal (fusing with the first at Cu2), one discal (swelling at the inner margin and fusing with the basal), and a basal (which includes the whole base save for a small costal creamy bar). *Hind wing* white, with a long bar of black-brown running from costa at base to just basad of the anal angle, spotted infrequently with white. On the costa are two triangular spots, the inner reaching the center of the cell, the outer reaching M1 near the cell-end. On the outer margin is a band of brown from outer angle to M3, from M3 to anal angle becoming differentiated into three black spots ringed with metallic blue-green. Marginal to the whole band is a narrow line of white, thicker in M3–Cu1 and Cu2–2A.

Length of fore wing: Male, 11–11.5 mm.

Holotype, male, Mt. Siwi, Arfak, Dutch New Guinea, 800 meters, May 4, 1928 (Dr. E. Mayr).

Paratype, one male, same locality and collector, April–June, 1928.

Holotype and paratype in the American Museum of Natural History.

Remarks. Differs from both other subspecies in its smaller size, the presence of two, instead of one, costal spots on the hind wing below, and the large amount of metallic scaling near the anal angle of this wing below. Differences between *arfakiana* and each of the other two are discussed more fully above.

FIELD NOTES ON *TABANUS NIGROVITTATUS* MACQUART[1]

By N. S. Bailey
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This horsefly was the subject of an intensive study that was started in mid-July, 1946, and was suspended only with the advent of winter. The fly might well be called the Saltmarsh Greenhead since its immature stages are evidently quite dependent on the conditions of the *Spartina* zones for their development. Wherever expansive salt marshes occur—from Nova Scotia to Texas—this insect is known and may become locally abundant. At such times it is extremely annoying to man and to domestic animals. Despite its general coastal distribution and common occurrence, the literature records only meagre details of its life history or of its specific requirements. This paper reports some initial results of the current investigation.

Abundance. Two incidents will serve to emphasize how abundant the species is at the height of its season. In Essex County, Massachusetts they appear about the first of July each year and are at their peak for the last three weeks of that month. Usually there is a marked decline in their numbers by early August. The decline is augmented when a northeast storm brings a spell of unseasonably cold, wet weather. The past summer was typical in this respect.

My real introduction to this species came on the warm, sunny afternoon of July fifteenth. A call was made at the farm of Mr. Martin Burns on U. S. Route 1 in Newbury. He was found mowing a field that lies above and just south of the Parker River. Two sturdy grey horses were hitched to the mowing machine. Tabanids were swarming around the patient animals. Practically all were *Tabanus nigrovittatus*, although a few other types —notably *T. atratus* and *Chrysops* species—were observed. The team was flecked with blood from the fly bites. The clots showed plainly on their light coats and gave an indication of favored feeding areas. In order of decreasing frequency, the chest region, the head and neck, the median side of the upper legs, the flanks, and the belly received most attention from the flies. However, the Tabanids were all over them and allowed them no respite. They were experienced horses and maintained a remarkable calm considering the severity of the incessant attack.

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[1] This investigation of the biology of *T. nigrovittatus* is being conducted for a joint board of the State Department of Public Health and the State Reclamation Board with a grant from the Massachusetts Legislature. I wish to acknowledge the generosity of Dr. Joseph C. Bequaert, Curator of Insects in the Museum of Comparative Zoology, who freely devoted his time to the determination of the Tabanidæ and liberally assisted me in many other ways. For the progress of this study I am greatly indebted to his friendly guidance.

It has long been known that such conspicuous objects as automobiles attract Tabanids. July eighteenth was another bright, warm day. After lunch the writer drove out Argilla Road towards Crane's Beach, Ipswich. Where the road crosses Fox Creek its bed is raised well above the marshes. The coupé was parked just beyond the bridge while some observations were made. On returning to the car an astounding number of greenheads were noted in it. The thought of making a timed collection suggested itself. The results are numerically emphatic. They give graphic evidence of the abundance of the Saltmarsh Greenhead under favorable circumstances. In fifteen minutes actual collecting time a total of 475 flies were taken by simply lifting a half-pint bottle, containing some alcohol, under them when they alighted on the inner roof covering. The disturbance caused them to fly downward into the liquid which quickly dispatched them. This collecting, at the rate of more than thirty a minute, could unquestionably have been continued much longer without noticeably diminishing the supply.

Mating. The mating of Tabanids is seldom observed. On one occasion only it was my privilege to find several pairs of *T. nigrovittatus* in copulation. At that time, unfortunately, the rarity of such an event was not realized or more attention would have been given to details. The morning of July twenty-fifth was very warm, humid, and hazy-bright. There was still some fog lingering over the marsh at Conomo Point, Essex, when I arrived at nine-thirty. On approaching the Point, a sharp left turn was made over a small but abrupt rise from which the road falls quickly away to the tide line. The first cottage on the left was surrounded on three sides by salt marsh. There was a convenient place to park in front of it. Immediately after getting out on the marsh a continuous low buzzing sound was noted. Then swarms of greenheads were seen hovering just a few inches above the dense cover of the fine marsh grass (*Spartina patens*). On the far side of the cottage a slight depression was discovered where a small, sparse patch of the larger and coarser *Spartina alterniflora* stood. On the upper surface of the broader blades of these plants some mating pairs of greenheads were seen. One was resting on the back of the other with its head about over the mesothorax of the mate beneath. Although it was possible to approach the paired flies more closely than is usual with individuals, they remained alert and were not too easy to catch with the net. The carrier could still take off readily and fly rather well. If disturbed they would move to another plant two or three yards away while retaining their relationship. Four or five pairs were caught there and they included the first males taken. Another stop was made at the same place on August sixth. In the thirty or forty minutes then spent on the marsh only five or six flies were seen. This time the owner of the cottage mentioned above was there. After explaining the purpose of the visit to him, Mr. Derby remarked that a carpenter he had engaged to work on the building in a previous year had told him of the hum produced by the hovering flies. This volunteered information was of interest in the light of my own experience. That spot is apparently a regular mating place for this species.

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PSYCHE

VOL. 54 JUNE, 1947 No. 2

EARLY INSECT LIFE*

BY FRANK M. CARPENTER
Harvard University

Most entomologists, whether concerned with insect control or taxonomy, are convinced that we have enough living insects to contend with, without bothering about those of prehistoric times. Paradoxical as it may be, however, man apparently owes his very existence to the early insects. Some three hundred million years ago, as the first Amphibia abandoned the aquatic environment of their ancestors and explored the possibilities of terrestrial life, they were obliged to find a new source of food. By that time, the insects had already become established on land and, being especially abundant near water, were readily available to them. The amphibians were thus able to survive in their new environment and eventually their descendants gave rise to reptiles, birds and mammals. Many geologic periods later—only a few million years ago, in fact—man evolved within the mammalian complex. Cannot the insects claim, therefore, that if it were not for their early ancestors, the vertebrates might have failed to gain a foot-hold on land and man might not have come into existence?

Let us consider the nature and extent of the early insect life to which we presumably owe so much. "Early" is of course a relative term, and to define my present use of it, I must refer to the conventional geologic timetable. Figure 1 lists the eras and periods of that part of geologic time with which paleontology is chiefly concerned. Of the three eras, the Paleozoic is the earliest and longest, beginning about 550 million years ago and extending up to some 190 million years ago. For convenience, it is divided into six periods of unequal duration, their limits being arbitrarily set with reference to extensive geologic events. In this account of early insect life, I am referring only to the insects of the Paleozoic era—from the first appearance of the group through the Permian Period.

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The question of the oldest geologic occurrence of any group of organisms is always a controversial one, for much depends on interpretation of fragmentary material and the definition of the group. Handlirsch showed in 1906 that the fossils described as insects from strata *older* than those of the Upper Carboniferous Period were not insects at all; and he concluded that the earliest record of the class was in the lower part of that period. During the past forty years discovery of three older insects has been announced. Two of these, identified as Collembola, have been described from Devonian rocks, the Rhynie Chert, of Scotland.[1] Without going into details, we can

TABLE OF GEOLOGIC PERIODS

ERA	PERIOD	APPROXIMATE TIME (IN MILLIONS OF YEARS)	
		DURATION OF PERIOD	SINCE BEGINNING OF PERIOD
CENOZOIC (AGE OF MAMMALS AND MAN)	QUATERNARY	1	1
	TERTIARY	69	70
MESOZOIC (AGE OF REPTILES)	CRETACEOUS	50	120
	JURASSIC	35	155
	TRIASSIC	35	190
PALEOZOIC (AGE OF INVERTEBRATES AND PRIMITIVE VERTEBRATES)	PERMIAN	25	215
	CARBONIFEROUS UPPER	35	250
	CARBONIFEROUS LOWER	50	300
	DEVONIAN	50	350
	SILURIAN	40	390
	ORDOVICIAN	90	480
	CAMBRIAN	70	550

Figure 1. Table of Geologic Periods. (Adapted from Romer's *Vertebrate Paleontology,* University of Chicago Press.)

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[1] R. J. Tillyard, Trans. Ent. Soc. London, 1928: 65–71; H. Womersley, Victorian Naturalist, 1934, vol. 51: 159–165; D. J. Scourfield, Proc. Linn. Soc. London, 152 sess., 1939–40: 113–131.

state that these fossils are very fragmentary, the largest specimen being only about a millimeter long. Many parts of the head and thorax have been found, but since only the first three abdominal segments are known, there is no evidence that the collembolan "spring" was present, or that the abdomen consisted of but six segments, as in living Collembola. Consequently, although such eminent authorities as G. H. Carpenter and H. Womersley have accepted the specimens as Collembola, I believe that doubt about their relationship will exist until additional fossils have been found showing those two characteristic features of the Collembola. As a matter of fact, as Imms and others have pointed out, the Collembola are not true insects—that is, although hexapodous arthropods, they arose independently from pre-insectan types. The possible occurrence of Collembola in Devonian rocks, therefore, has no direct bearing on the earliest record of true insects.

The other discovery of an insect in rocks older than the Upper Carboniferous was announced by the French paleontologist, Dr. Pierre Pruvost, in 1919. The specimen concerned was found in Lower Carboniferous strata of Nova Scotia (Horton's Bluff), and identified by Pruvost as a member of the extinct Order Palæodictyoptera.[2] However, examination of this fossil, which is now in the Peabody Museum at Yale University, convinces me that it is in reality part of a plant stem. A similar conviction was expressed by Dr. David White,[3] then paleobotanist of the United States Geological Survey, who studied the specimen shortly after it was found, although he did not publish his conclusion.

According to our present knowledge, therefore, the earliest unquestionable insects occur in Upper Carboniferous strata. This first occurrence is not extensive, but it does indicate the approximate time of origin of the insects. Let us return for a moment to the geologic timetable, and examine in more detail the Upper Carboniferous Period (Figure 2). This represents an interval of

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[2] La Faune continentale du terrain Houiller du Nord de la France, p. 283.

[3] In a letter dated May 11, 1914, and on file in the Peabody Museum.

PERIOD	STAGES		INSECT ORDERS
PERMIAN	Upper		Coleoptera
	Middle		Thysanoptera, Perlaria
	Lower		*Protoperlaria, Protelytroptera,* Ephemerida, Odonata, Corrodentia, Hemiptera, Mecoptera, Neuroptera
UPPER CARBONIFEROUS	Stephanian		*Protohemiptera*
	WESTPHALIAN	C & D	*Megasecoptera, Caloneurodea*
		A & B	*Palaeodictyoptera,* Blattaria
	Upper Namurian		*Protodonata, Protorthoptera*

Figure 2. The First Occurrence of Insect Orders in the Permian and Carboniferous Periods. Names of exinct orders are italicized.

about thirty-five million years, and on the basis of its flora and fauna, is divided into three main stages, the Upper Namurian, Westphalian, and Stephanian. The record of insects is very scanty in the oldest of these; not until the late Westphalian and Stephanian rocks are insect remains sufficiently abundant and preserved to give us a concept of the fauna. Nevertheless, three species are known from the Upper Namurian, at the very base of the Upper Carboniferous, and they constitute the earliest record of the insects. One of these (*Erasipteron larischi* Pruvost), from Czechoslovakia, consists of part of a wing, which, though incomplete, clearly belongs to a member of the extinct Order Protodonata, related to the Odonata. Another fossil (*Stygne roemeri* Handl.), from Germany, is a nearly complete wing with orthopteroid features that place it in another extinct order, the Protorthoptera. The third specimen (*Metropator pusillus* Handl.), from Pennsylvania, is a very fragmentary wing which might have belonged to any one of several orders. Now this is truly a meagre record, but it does reveal two facts: *first,* insects with fully developed wings existed in the earliest part of the Upper Carboniferous Period, about 250 million years ago; and *second,* at least two orders, widely separated phylogenetically, occurred at that time. We can infer from this record that insects must have arisen at least as far back as the Lower Carboniferous in order for such diversity to be attained by the beginning of the Upper Carboniferous. This inference becomes even more obvious, when we bear in mind that morphological studies have shown that the most generalized or primitive insects were wingless, like the Thysanura. Apterous species must have existed, therefore, even before the winged ones.

So much for the first record of the insects. Let us now briefly consider the development of the class during the rest of the Paleozoic era. Referring again to the Upper Carboniferous table (Figure 2) we find that as we go up through the several stages, additional orders appear, and there is an increase in the total number of orders. From the lower half of the Westphalian stage (A and B) there are forty species known, representing the two orders previously mentioned (Protodonata and Protorthoptera), as well as the extinct order Palæodictyoptera and the existing order Blattaria or cockroaches. In the upper half of the Westphalian stage (C and D), about 15 million years after the first record of the insects, we come to the level of the Mazon Creek nodules in Illinois, second only to the Commentry shales in France as a source of Carboniferous insects. From this part of the Westphalian more than four hundred insects are known, representing the four orders already mentioned and in addition two other extinct ones, the Megasecoptera and Caloneurodea. From the Stephanian stage, which includes the Commentry deposit, about fifteen hundred species have been described, belonging to the orders previously mentioned as well as still another exinct one, the Protohemiptera. Thus, we see that by the end of the Upper Carboniferous seven orders of insects had come into existence, of which one, the Blattaria, survived for some two hundred forty million years to the present time.[4]

Let us now continue into the Permian Period (Figure 2), which represents an interval of about twenty-five million years. In the lower or oldest strata of the period eight orders have been found in addition to the seven which have persisted from the Carboniferous. Two of these, the Protoperlaria and Protelytroptera, are extinct, but the others are living orders. These are the Ephemerida, Odonata, Corrodentia, Hemiptera, Mecoptera, and Neuroptera. This fauna was an extremely interesting one, combining as it did eight extinct and seven existing orders. The Lower Permian was the last time, so far as our records now show, that the extinct orders outnumbered the existing ones. In Middle Permian rocks, Thysanoptera and Perlaria have been found; and in upper Permian strata the Coleoptera appear. These make a total of eighteen living and extinct orders of insects which came into existence before the end of the Paleozoic era, about two hundred million years ago; and of these ten are still living.

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[4] I have not included in this account several extinct orders which are based upon very fragmentary specimens.

This brief survey gives an idea of the extent of the early insect life. The fauna was obviously a complex one—probably more so than we fully realize, for our present roster of the orders existing at the time is surely far from complete. Nevertheless, the variety of insect types probably fell far short of that which exists now, their biological environment being relatively simple. The plants of the time were largely seed-ferns and other gymnosperms; angiosperms were entirely absent, and, incidentally, did not arise for many millions of years later. It is difficult for us, living at a time when angiosperms dominate the plant world, to imagine a time of their complete absence; and equally difficult to imagine an extensive insect fauna without them. Also, there was a complete absence of birds and of mammals. Insects were then the only flying creatures on earth; they could readily escape by flight from their amphibian and reptilian enemies without danger of pursuit. Certainly the life of the insects must have been very different then from what it is now—with birds, bats, man, and DDT.

Our knowledge of the habits, life histories, and food of these early insects is necessarily slight, but certain inferences can be made from their structure, as we now know it. Let us see what this was like and what conclusions can be reached.

The order Palæodictyoptera, which existed during the Upper Carboniferous and Permian, is a negative and ill-defined group. Attempts to divide it into two or more orders have not proven successful, because some species seem to merge into the Ephemerida, and others into the Orthopteroids. Nevertheless, I believe that most of the one hundred fifty species which have been described are members of one order. Their closest living relatives are the Ephemerida and, to a lesser extent, the Odonata. The fact that all complete specimens are preserved with their wings outspread shows that, like the Ephemerida and Odonata, they were palaeopterous, i.e., unable to fold their wings back over the abdomen at rest. They had nearly similar fore and hind wings and were apparently weak fliers. Although they are mostly preserved as isolated wings, enough whole specimens have been found to give us a slight knowledge of their body structure. They were primitive insects, probably more so than any other known winged insects, but they did have some specializations. It should be noted, in this connection, that no remains of bodies of any insects have been found in the older half of the Upper Carboniferous strata. Not until we come to the Mazon Creek deposits, about 15 million years after the first record of the insects, are body remains known. This probably would have provided ample time for extensive specialization to develop. At any rate, the Palæodictyoptera were more primitive than any winged insects now living. They show about the same range in size as living dragonflies, many having a wing expanse of about two inches. The head was relatively small; the mouth-parts mandibulate and inconspicuous. Their antennæ are unknown, except for the proximal segments; probably they were moderately long and multisegmented. The thoracic segments and legs were nearly homonomous. The most striking characteristic of the Palæodictyoptera was the presence of paired membraneous lobes on the prothorax; these resembled miniature wings and are usually considered homologues of the functional meso- and metathoracic wings. The abdominal segments showed little differentiation, and the abdomen terminated in a pair of long, multisegmented cerci. Well preserved specimens have paired lateral lobes on each abdominal segment. The immature stages of the Palæodictyoptera are completely unknown. Several vague and fragmentary specimens, which are probably insect nymphs of some sort, have been assigned to the Palæodictyoptera, but they could just as well belong to certain other groups. The paired abdominal lobes of the adult have been generally interpreted as vestigial tracheal gills of the nymphs. This of course implies that the nymphs were aquatic; and in view of the close relationship between the Ephemerida and Odonata, both of which have aquatic nymphs, we may infer this to have been the case. From this you will see that our knowledge of the Palæodictyoptera is not great. Their general activities were probably much like those of the present-day may-flies, crawling and fluttering among the plants bordering the ponds or swamps in which their nymphs developed—inoffensive creatures whose only claim to fame is their antiquity and proximity to the great ancestor of all insects. They had no defense against the more powerful, predaceous insects which developed during the later Carboniferous and Permian, and for which they must have been easy prey.

Related to these Palæodictyoptera was another order of ephemerid-like creatures, termed the Megasecoptera. They were small to large insects, with a wing expanse ranging from one-half to five inches, and, like the Palæodictyoptera, they were unable to fold their wings over the abdomen. Until about 12 years ago they were known exclusively from the Upper Carboniferous; many Permian species have since been found, and it has become apparent that the order did not attain its greatest development until that period. They had moderately long antennæ, and extremely long cerci. In the Carboniferous species the head was small and short, but in some of the Permian types it was prolonged into a rostrum, probably much like that of the scorpion-flies. The older forms had mandibulate mouth-parts, and this was probably true also of the later species. The thorax and abdomen were slender, and, in the main, generalized in structure. In certain Carboniferous species, however, the prothorax was highly modified, bearing conspicuous projections or spines, which may have had some protective value. The legs of most were of the ordinary walking type, but in one Carboniferous genus (*Mischoptera*) the fore legs were short and raptorial in form though there are no other indications of predaceous habits. The wings were the most characteristic structures of the Megasecoptera. In most species they were very narrowed basally, and in one family they were arcuate, as in many families of living insects. Two abdominal structures are noteworthy: the very elongate cerci, which surpass in length those of most other insects; and, in certain families, lateral gill-like processes, resembling those of the Palæodictyoptera. Nothing is known of the immature stages of the Megasecoptera, but the presence of the supposed gill-vestiges just mentioned suggests that at least some of them had aquatic nymphs.

The Megasecoptera were probably no better fliers than the Palæodictyoptera, and their long cerci must have handicapped them in their attempts to escape from enemies. Perhaps this had something to do with their abrupt disappearance at the close of the Permian, for no sign of them has been found in later strata.

We next come to the insect dinosaurs—the Protodonata. These include the largest insects known, living or extinct. Although all species were large, as insects go, not all were giants, as is usually stated; some had a wing expanse of five inches, which is well within the limits of many living insects. Three very large species have been found, all belonging to the family Meganeuridæ. One, from the Carboniferous of France, was about twenty-six inches across the wings; the other two, from the Lower Permian of Kansas and Oklahoma, were somewhat larger, with a wing expanse of about thirty inches. The distribution of these species, both in space and time, indicates that the giant meganeurids inhabited an extensive area of the earth for some fifty million years, though the whole order became extinct shortly after the close of the Permian Period. The protodonates resembled dragon-flies in general appearance, and the earlier forms were probably directly ancestral to the true Odonata. They had large, toothed mandibles and spiny legs, and were undoubtedly predaceous. What they fed on, we can only guess. The contemporary slow moving Palæodictyoptera and Megasecoptera, which, because of their wing structure, were unable to hide easily among plants or under rocks, were probably their chief source of food. Protodonate nymphs are unknown. They were probably aquatic, although Dr. August Krogh has asserted that nymphs of the giant meganeurids could not have breathed through caudal or rectal tracheal gills, as odonate nymphs do, since in order to convey the necessary quantity of oxygen to the head, their tracheæ would have required a cross-section greater than that of the body itself. However, passage of oxygen in the tracheæ might well have been sufficiently aided by muscular movement to make this mechanism practical. At any rate, the adult Protodonata and Odonata are so much alike, I find it difficult to believe that their nymphs were very different.

The insects which we have been considering so far are primitive types which we would expect to find as part of early insect life. The group we are now to discuss is not in this category. For although their wings were of the palæopterous type, the head was modified into a long rostrum, with suctorial mouth-parts. The best preserved specimen (*Eugereon*) of this group has been found in Upper Permian rocks of Germany, but other representatives, also with elongate beaks, have been collected in Carboniferous strata of France, Belgium, and England. Since these insects were at first thought to have been related to the Hemiptera, Handlirsch termed the order the Protohemiptera. The choice of name was unfortunate, for, with the discovery of new specimens, it has become increasingly clear that they had nothing to do with the Hemiptera, but are instead closely related to the Palæodictyoptera. The order was obviously a widely distributed one, members having been found in Permo-Carboniferous strata of both Europe and North America; and specimens from Triassic rocks of Australia show that it persisted into the Mesozoic. The Triassic representatives, by the way, are remarkable in that the fore wings had a very large stridulatory area. The Palæozoic Protohemiptera had long cerci and well developed prothoracic wing lobes, like those of the Palæodictyoptera. The presence of suctorial mouth-parts raises the question of feeding habits. It is obvious from their modified mouth-parts that the Protohemiptera consumed liquid foods; whether this was plant juice, from such gymnosperms as lycopods, seed-ferns, and horse-tails, or the blood of reptiles and amphibians, is uncertain. But it is most interesting that as far back as the Upper Carboniferous, at least two hundred twenty-five million years ago, the suctorial mechanism had been developed in insects; and also that this device originated in relatives of the may-flies and dragonflies, quite independent of its subsequent development in the Hemiptera and the Diptera.

The largest extinct order of Carboniferous and Permian times was the so-called Protorthoptera. This included a bewildering variety of insects, suggestive of most of the orders to which we apply the term Orthopteroidea. Some show definite traces of characteristics found in the cockroaches, others recall the mantodean and even the saltatorial Orthoptera; but so far no satisfactory division of the Protorthoptera has been proposed. All of them were neopterous, i.e., folded their wings over the abdomen at rest. The more primitive types, however, possessed pronotal lobes, like those of the Palæodictyoptera. Their wings were unequal, the hind pair having an expanded and plicate anal area. In certain Permian species, and perhaps also some Carboniferous ones, the fore wings were tegminous and distinctly punctate. A prominent ovipositor and cerci were present in most species. Apart from the wings, the prothorax showed the greatest amount of diversity. In many Carboniferous species, the prothorax was long and even armed with large spinous projections, whereas in others this segment was small and inconspicuous. The legs also showed much diversity. The fore legs of some were clearly raptorial,

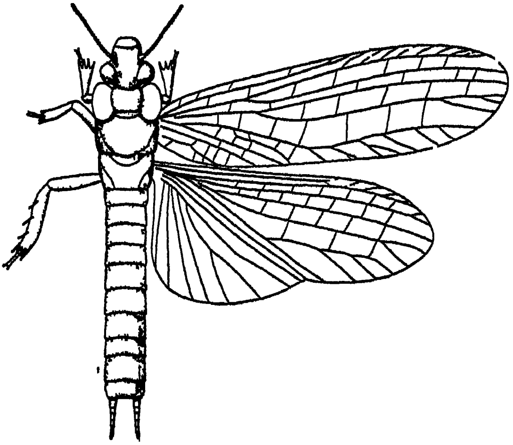

Figure 3. *Probnis speciosa* Sellards (Order Protorthoptera), from the Lower Permian of Kansas. Original restoration, based upon specimens in the Museum of Comparative Zoology.

long and armed with spines and teeth; in others they were curiously modified, perhaps for digging or climbing (Figure 3). The hind legs were specialized in some species for leaping, as in grasshoppers and crickets. It is apparent, therefore, that these early orthopteroids were a varied lot. They probably inhabited small seed-ferns, the phytophagous species feeding on the leaves and the predaceous ones on Palæodictyoptera and other defenseless insects. They were not very large creatures, though a few attained a wing-expanse of six inches. The nymphs of several families are known; they resembled the adults closely and were obviously terrestrial.

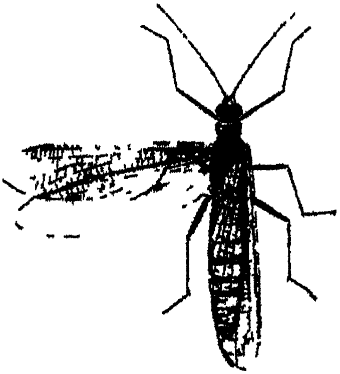

Figure 4. *Paleuthygramma tenuicornis* Martynov (Order Caloneurodea), from the Upper Permian of Russia. (After Martynov.)

Related to the Protorthoptera, but different enough to require ordinal separation, were the Caloneurodea, which existed during the Upper Carboniferous and Permian periods. They were slender insects, with long antennæ and tenuate wings (Figure 4). The largest of them had a wing expanse of five inches. They differed from the Protorthoptera chiefly in having hind wings like the fore wings, with no enlargement of the anal area. In general appearance the caloneurodeans probably resembled the long-horned grasshoppers, except that their legs were cursorial, not modified for jumping. Their nymphs are unknown.

The extinct orders which we have been considering have had a geologic record extending throughout the Carboniferous and Permian. We now come to two orders which are known only from the Permian period. One of these, the Protoperlaria, is the best known of all the extinct orders of insects, their remains being very abundant in Lower Permian rocks of Kansas and Oklahoma. The adults were similar to the existing stone-flies, but they had pronotal lobes like the Palæodictyoptera, five tarsal segments, and a distinct, though small, ovipositor. The abdomen had long cerci and nine pairs of vestigal lateral gills, recalling those of the Palæodictyoptera and some Megasecoptera. That they were vestigial gills is shown by the nymphs (Figure 5). These were well adapted to

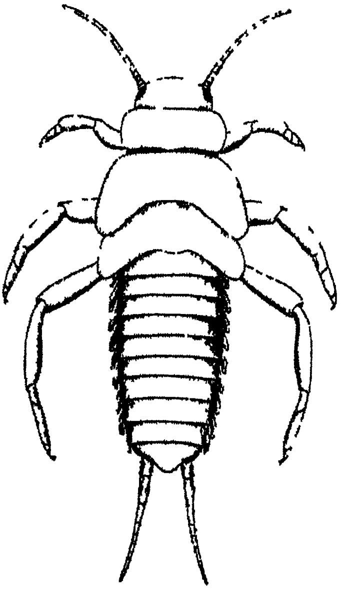

Figure 5. Protoperlarian nymph, from the Lower Permian of Kansas. Original restoration, based upon specimens in the Museum of Comparative Zoölogy.

an aquatic life, with swimming legs, and the lateral abdominal gills.

The other extinct Permian order is the Protelytroptera, which includes the most highly modified of all the Paleozoic insects. They had true elytra, very thick and convex, though with vestiges of venation (Figure 6). The hind wings were large, with a greatly expanded anal region, and with hinges on the longitudinal veins enabling the wing to fold up transversely as well as lengthwise. In general appearance these insects were highly suggestive of beetles, but the venation of their hind wings shows clearly that they were not at all allied to the Coleoptera. They might be related to the roaches or to the Dermaptera, but most likely they represent an early and independent origin of the elytrophorous condition. Nothing is known yet of their mouthparts or of their immature stages.

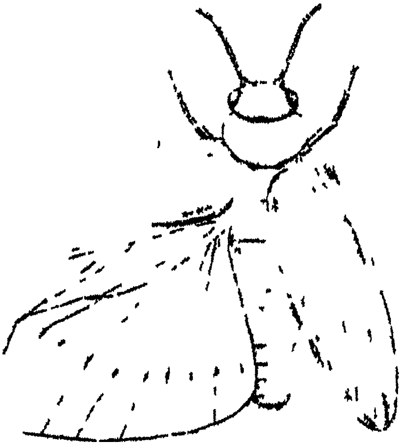

Figure 6. *Protelytron permianum* Tillyard (Order Protelytroptera), from the Lower Permian of Kansas. Original restoration, based upon specimens in the Museum of Comparative Zoölogy.

The foregoing discussion has dealt only with the *extinct* insect orders of the Upper Carboniferous and Permian periods. Let us now turn to the living orders. As we noted earlier, although ten of these are known from Paleozoic rocks, only one has a record which goes back to the Upper Carboniferous—the Blattaria or cockroaches. Their oldest remains are found in early Westphalian strata, which were deposited about two hundred forty million years ago. These first specimens consist only of wings, but complete or nearly complete specimens have been found in late Westphalian and Stephanian rocks. It is clear from these fossils that even that early in the earth's history, the roaches were not very different from what they are now. They were flat, and had a broad pronotum and tegminous wings like modern types. The venation, also, was similar to that which occurs in many of our living species—so much so that it is not easy to find obvious differences between Carboniferous and existing members of the group. Nymphal forms and several egg cases, which have been found in Permian rocks, serve to emphasize their similarity. Roaches are the most abundant of all Carboniferous insects. However, this does not necessarily mean, as it has usually been interpreted, that they were the prevailing insects of the time; it merely means that they were numerous in a particular region or environment. Most insect-bearing rocks were first deposited as mud, and the roaches presumably thrived in moist or damp regions having a luxuriant plant growth. The picture we get from the fossils can therefore be misleading, for it gives us a conception of the local biota only; if we had equally good samples of the fauna of dry regions, we would probably find the roaches less numerous. The size of the Paleozoic roaches has also been erroneously described. Although the statement is often made that giant roaches lived in the Carboniferous, no fossil specimens have been found which exceed the size of some of our living species. It is true, of course, that the *average* size of fossil roaches exceeds that of the existing species; but that is because the large roaches had a better chance of being preserved as fossils than the small ones. This selective aspect of preservation is often overlooked.

Let us now consider the existing orders which first appear in the Permian. The best known of these is the Ephemerida or may-flies, remains of which have been found in the Lower Permian rocks of Kansas and Oklahoma, as well as in Upper Permian deposits of Russia. They were about the same size as living may-flies, with a wing expanse of less than two inches. Their antennæ were much longer than those of existing species, however, and the prothorax was slightly broadened, with an indication of membranous lobes in some species. The abdomen, which terminated in long cerci and a median caudal filament, closely resembled that of Recent members of the order. The wings were their most interesting structures. Living members of the order, and even those from Mesozoic rocks, have greatly reduced hind wings; but in the Permian species, the hind wings were about equal to the fore wings in size, and had nearly the same venation. Some of the specimens from the Lower Permian of Kansas are clearly in the subimaginal stage, showing that this distinctive phase of ephemerid metamorphosis occurred even in those early days. Several nymphs, found in the Permian of Oklahoma and Russia, have the characteristics of living ephemerids—swimming legs, caudal filaments, and lateral abdominal gills.

True Odonata are represented in Permian strata only by wings. They have been found in Permian rocks in North America, Russia and Australia. Most species were surprisingly small, a few being less than an inch and a half across the wings. Both dragon-fly and damsel-fly types were present in the Lower Permian. Their nymphs are unknown, but they were almost certainly aquatic.

The Corrodentia or bark lice are relatively common in Permian strata. Like existing species, they were very small and even minute, most having a wing expanse of about half an inch, some a quarter of an inch. The body structure of a few Lower Permian species is well known. The head was relatively large, with long antennæ and prominent eyes (Figure 7). Surprising enough, the anterior part of the head was prolonged into a short rostrum, but whether the mouth-parts were adapted for chewing or some other method of feeding has not been determined.

At any rate the maxillary and labial palpi were conspicuous and generalized in structure. Another interesting feature of the early psocids was their wings. In existing species the hind pair are much smaller than the fore, with a reduced venation, but in the Lower Permian species the fore and hind wings were alike. Some of the Upper Permian members show the beginnings of hind wing reduction. Presumably these small creatures had essentially the same habits as many modern species, living under bark of trees or in leaf mould—but the trees and leaves were very different from those now inhabited by their descendants.

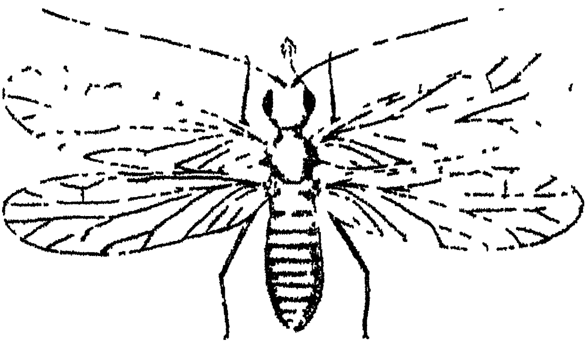

Figure 7. *Dichentomum tinctum* Tillyard (Order Corrodentia), from the Lower Permian of Kansas. Original restoration, based upon specimens in the Museum of Comparative Zoology.

All the true bugs, i.e., Hemiptera, of the Permian were members of the suborder Homoptera. Most of them were small, with a wing expanse of less than an inch, though in a few this reached two inches. The Lower Permian species were much less specialized than the Upper Permian ones, but they had the characteristic beak and maxillary and mandibular bristles of existing bugs. The wings are interesting because they were about equal in size, and because the hind wing had the venational features of psocid wings. The best known of the Lower Permian Hemiptera had a long, straight tube projecting from the end of the abdomen, but whether this was an ovipositor or respiratory tube remains to be determined. By Upper Permian time the Homoptera had developed a variety of families, some of them approaching certain existing families (Figure 8). There can be no doubt, on the basis of their known structure, that these early bugs had already settled down to a diet of plant juices.

We now come to the two remaining orders of insects which appear in the Lower Permian, the Mecoptera and Neuroptera. Their presence in Lower Permian rocks is interesting and surprising. Since existing members of both these orders have complete metamorphosis, we can conclude that the Permian species also had that type of development—unless, of course, we grant that complete metamorphosis might have arisen independently in the two orders, which seems improbable. True larval forms have been found in Permian deposits of Kansas, but their ordinal affinities have not been determined with certainty. The Lower Permian Mecoptera, or scorpion-flies, were very small, with a wing expanse of about an inch, though some of the later Permian species were more nearly the size of existing members of the order. Their body structure was much like that of certain living genera, such as the Australian *Chorista,* the head including a short rostrum (Figure 9). During the late Permian, and, inci-

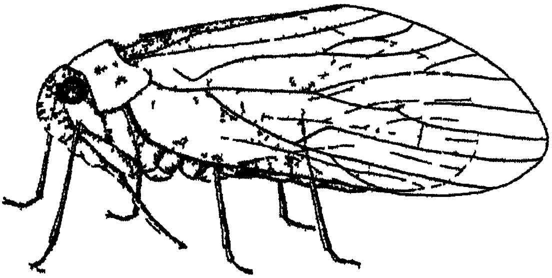

Figure 8 *Permocicada interga* Beck (Order Hemiptera), from the Upper Permian of Russia (After Becker Migdisova)

dentally, the early Mesozoic, the Mecoptera were relatively abundant and diverse. In one Permian deposit in Russia the Mecoptera make up 20% of the insect fauna found there, though at the present time they comprise less than .05% of the world's insect fauna. The Neuroptera of the Permian are no less interesting than the scorpion-flies. Two distinct types occur in Lower Permian rocks—the Raphidiodea or snake-flies, and the Planipennia. Very little is known of their body structure, but their wings indicate that, whereas the Lower Permian snake-flies were primitive and closely related to existing families, the Planipennia were highly specialized, and only remotely related to existing groups. In Upper Permian rocks, however, the Planipennia are represented by an extensive series of fossils which are close to certain living families, such as the Berothidæ, Sisyridæ, etc.

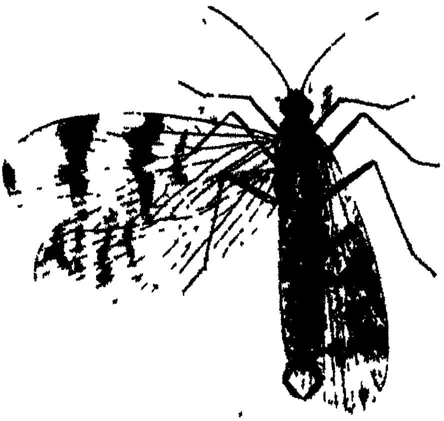

Figure 9. *Agetochorista tillyardi* Martynov (Order Mecoptera), from the Upper Permian of Russia. (After Martynov.)

There remain to be considered now three other orders, two of which, the Thysanoptera and Perlaria, appear first in Middle Permian rocks, and the third, Coleoptera, in late Permian deposits. The earliest Perlaria have been found in Russian strata and although they are very fragmentary, their identification is substantiated by the presence of more definite specimens in late Permian rocks of Australia. The latter were considered by Tillyard as being very closely related to the existing Eustheniidæ of the Australian region. The Thysanoptera or thrips, also found in Russian deposits, are of course minute and the details of the wings are not known; but the fossils certainly show the general characteristics of the thrips.

The first unquestionable Coleoptera, or beetles, are found in the Upper Permian of Russia and Australia. Unfortunately, complete specimens are unknown, though several well preserved elytra have been found. The family relationships of the fossils cannot be ascertained on these structures alone; but several types of elytra are represented, including some which are alike those of the Cupedidæ, and others which recall those of the Hydrophilidæ. It should be noted that since beetles are very abundant in Triassic deposits, their presence in the Permian is not surprising.

This then, is a general picture of early insect life. Our knowledge of it is limited, and there are many gaps to be filled, but we do have some idea of its nature. In reality, two faunas existed during the geologic periods considered—a Carboniferous fauna and a Permian one. The contrast between these two is fully as great as that between the faunas of the Triassic and the present. Even by late Permian time, about one-third of all the living orders of insects had come into existence, and the abrupt appearance of so many existing orders in the Lower Permian suggests that some of them lived in Carboniferous time, though not yet found in strata of that period. This early insect fauna included both predators and plant feeders, some of which had suctorial mouth-parts. The metamorphosis of the Carboniferous species, so far as known, was of the incomplete type, some apparently having aquatic nymphs; but by early Permian time, complete metamorphosis had been acquired. All of this took place before the existence of flowers or mammals or birds—to say nothing of man. It is no wonder that the insects have such a tenacious hold on what we consider to be our planet.

A LIST OF SPIDERS FROM MONA ISLAND, WITH DESCRIPTIONS OF NEW AND LITTLE KNOWN SPECIES[1]

By Elizabeth B. Bryant
Museum of Comparative Zoölogy

The small Mona Island, between Haiti and Puerto Rico, is rarely visited by collectors and its spider fauna is little known. In 1914 Mr. N. Banks described two new species from there in a short paper published in the Bulletin of the American Museum of Natural History, and much later, 1929–1930, Dr. A. Petrunkevitch noted in his "Spiders of Porto Rico" fifteen species, of which three were new.

Recently, two small collections from Mona have been received by the Museum of Comparative Zoölogy. The first was from Dr. Serrallés of Puerto Rico, who spent a week there during April, 1944. He very kindly sent the material to me for identification. The second collection was from Mr. Harry Beatty, who spent the month of August of the same year there. Neither collection is large, either in species or specimens, but as the island is small and not very diversified, the spider fauna probably is small. Four species are new.

This paper lists the forty-one species that have been reported from Mona and includes descriptions of the four new species and the hitherto unknown form of *Hentzia squamata* (Petr.), with elongate mandibles. Collecting at a different season would undoubtedly add many more species.

The following is a list of the species collected by Dr. Serrallés in April and by Mr. Beatty in August 1944.

Fam. Filistatidæ

♀ *Filistata hibernalis* Hentz Apr.Aug.

Fam. Œcobiidæ

♀ *Œcobius benneri* Petr. Apr.

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[1] Published with a grant from the Museum of Comparative Zoölogy at Harvard College.

FAM. OXYOPIDÆ

♀ *Peucetia viridans* Hentz Aug.
♀ *Oxyopes salticus* Hentz Aug.
♀ *Hamataliwa haytiana* (Chamb.) Apr.

FAM. PHOLCIDÆ

♀ *Physocyclus globosus* (Tacz.) Apr.Aug.

FAM. THERIDIIDÆ

♂ ♀ *Anelosimus studiosum* (Hentz) Apr.
♂ ♀ *Conopistha argyrodes* (Walck.) Apr.Aug.
♂ ♀ *Latrodectus mactans* (Fabr.) Aug.
♀ *Theridion insulicola* spec. nov.

FAM. ARGIOPIDÆ

pullus *Aranea displicata* (Hentz) Apr.
♂ ♀ *Argiope argentata* (Fabr.) Apr.Aug.
♀ *Cyclosa caroli* (Hentz) Aug.
♀ *Eriophora* (scape broken) Apr.Aug.
♀ *Edricus crassicauda* (Keys.) Aug.
♀ *Eustala anastera* (Walck.) Aug.
♀ *Gasteracantha cancriformis* (Linn.) Apr.Aug.
♀ *Leucauge argyra* (Walck.) Apr.
♀ " *regni* (Simon) Apr.
♂ ♀ *Metepeira virginensis* Chamb. and Ivie Apr.
♀ *Neoscona volucripes* (Keys.) Apr.
♂ ♀ *Nephila clavipes* (Linn.) Apr.Aug.
♀ *Parawixia cambridgei* Bryant Aug.
♂ ♀ *Wixia serrallesi* spec. nov.

FAM. SPARASSIDÆ

♀ *Stasina macleayi* Bryant Apr.
♂ *Olios bicolor* Banks Aug.
♀ *Heteropoda venatoria* (Linn.) Apr.

FAM. SELENOPIDÆ

♂ ♀ *Selenops insularis* Keys. Apr.Aug.

FAM. THOMISIDÆ

♂ ♀ *Misumenops celer* (Hentz) Aug.

FAM. CLUBIONIDÆ

♂ ♀ *Aysha tenuis* (L. Koch) Apr.Aug.
♂ ♀ *Chiracanthium inclusum* (Hentz) Aug.
♀ *Wulfila immaculata* Banks Aug.

FAM. SALTICIDÆ

♂ ♀ *Habronattus translatus* (Peckham) Aug.

♂ ♀ *Hentzia squamata* (Petr.) Apr.Aug.
♂ ♀ *Sidusa mona* spec. nov. Aug.
♀ *Stoides placida* spec. nov. Aug.

The following is a list of species reported from Mona but not seen by me.

FAM. OXYOPIDÆ

Oxyopeidon rana Simon (Petrunkevitch, 1929)

FAM. ARGIOPIDÆ

Argiope trifasciata (Fabr.) (Petrunkevitch, 1929)

FAM. CTENIDÆ

Oligoctenus ottleyi Petrunkevitch (1930)

FAM. THOMISIDÆ

Misumenops asperatus (Hentz) (Petrunkevitch, 1930)

FAM. SALTICIDÆ

Siloca minuta Petrunkevitch (1930)

FAM. THERIDIIDÆ

Theridion insulicola spec. nov.

Figure 1

Female. Length, 3.0 mm., ceph. 1.2 mm., abd. 1.7 mm. long, 1.6 mm. wide.

Cephalothorax pale, shining, very slightly convex, anterior margin less than half the greatest width, widest between the third pair of legs, thoracic groove covered with a broad black line that does not reach the ocular area or the posterior margin, row of black bristles from the p.l.e. to the groove and two long median bristles between the groove and the posterior eyes; *eyes* cover the anterior margin, anterior row recurved, a.m.e. largest of the eight, separated by less than a diameter, and from a.l.e. by a radius, posterior row straight, eyes equidistant, lateral eyes subequal and touching, p.m.e. separated by less than a diameter, each eye surrounded by a black ring; *quadrangle* higher than wide and narrower behind than in front; *clypeus* higher than the eye area, a small median black spot on the margin; *mandibles* pale, shaded with gray on the median margin, long, cone-shaped, weak, groove short, fang short; *labium* fused to the sternum, wider than long, tip not narrowed; *maxillæ* almost twice as long as the labium, slightly inclined, tips transverse; *sternum* pale, shaded with gray about the margins and a short median gray stripe at the tip, triangular, as wide as long, ending in a broad round tip in front of the fourth coxæ, fourth coxæ separated by more than a diameter; *abdomen* pale, with a short median gray spot at base, followed by a pair of converging gray spots, entire abdomen covered with black granules, each bearing a long colorless bristle, strongly convex, almost as wide as long, venter a dull yellow with small pale spots; *legs,* 1–2–4–3, not varying much in length, pale, with black spots on ventral side, so that the legs have a spotted appearance, no spines but rows of hairs and bristles, III and IV tibiæ with a median dorsal bristle; *epigynum,* area wider than long, divided by a narrow median septum, each side pale oval areas, which probably are the openings, near the posterior margin and below the surface, each side, a transverse oval sac, with a small circular sac just anterior.

Holotype ♀ Mona Island, 5 April 1944 (Serrallés).

Theridion insulicola differs from *Theridion antillanum* Simon, from St. Vincent, and reported by Petrunkevitch from Puerto Rico, by the smaller size, the quadrangle of median eyes narrower behind, and the black granules on the abdomen. These granules are very conspicuous, even after the long bristles have been broken off.

FAM. ARGIOPIDÆ

Genus *Parawixia* F.O.P.-Cambridge 1903

Parawixia cambridgei Bryant

Parawixia cambridgei Bryant, 1940, p. 342, figs. 104–106. "♂ ♀ Cuba; Oriente, coast below Pico Turquino, June 1936" (Darlington).

This species was described from the Oriente, Cuba, and afterwards found in a collection from Diquini, Haiti, made by Dr. W. W. Mann. It has the same number of tubercles on the abdomen as *Marxia grisea* McCook, American Spiders, 1893, 3, p. 195, pl. 13, fig. 10, described from a female, 8.00 mm. long, from Biscayne Bay, Florida. The two genera belong to separate sections of the family. The male of *Marxia* has two long bristles on the patella of the palpus, and both male and female have five teeth on the lower margin of the fang groove. The male of *Parawixia* has but one bristle on the patella of the male palpus, and the lower margin of the fang groove has but three teeth. McCook does not state the number of teeth on the fang groove and he evidently placed the species in the genus *Marxia* because of the abdominal tubercles. He does describe the cephalothorax rather definitely, as "divided into two low ridges by a lateral depression passing just behind the ocular quad, giving the head a lumpy appearance." These two low elevations just posterior to the eyes are even more conspicuous in the male than in the female but until the number of teeth on the fang groove on the type specimen is known, the two can best be considered as separate species.

♀ Mona Island, August 1944 (Beatty).

Genus *Wixia* O.P.-Cambridge 1882

Wixia serrallesi spec. nov.

Figures 2, 3

Male. Length, 6.6 mm., ceph. 3.1 mm. long, 3.0 mm. wide, abd. 3.6 mm. long, 2.8 mm. wide.

Cephalothorax brown, with a broad pale median stripe from the lateral eyes to the posterior margin, anterior margin shaded with brown and a mass of white hairs posterior to the lateral eyes, a narrow marginal pale stripe, anterior margin about half the greatest width, sides evenly rounded, eye area carried foreward, cephalothorax rather flat, thoracic groove long and deep; *eyes* in three groups, anterior row strongly recurved, a.m.e. largest of the eight, convex, separated by about a diameter, p.m.e. slightly smaller than the a.m.e., separated by almost two diameters, a short bristle between each a.m.e. and p.m.e., lateral eyes small, subequal, on a common tubercle, a long bristle anterior and another posterior to the tubercle; *quadrangle* of median eyes slightly narrower behind and not as high as wide; *clypeus* below a.m.e. less than a diameter of a.m.e.; *mandibles* dark brown, vertical, small, cone-shaped, fang groove oblique, four teeth on the upper margin, the second tooth from base of the fang the small-est, lower margin with four small, subequal teeth; *labium* fused to the sternum, brown, tip rebordered and pale, wider than long; *maxillæ* brown, distal half pale, about twice as long as labium; *sternum* pale, triangular, three-quarters as wide as long, widest between the second coxæ and pointed in front of the fourth coxæ, coxæ pale, I coxa with a hook, III and IV coxæ with a strong dark cusp or spine about the middle, IV trochanter with a cusp; *abdomen* oval, with a pair of well-defined tubercles between the shoulder angles that extend upwards, first pair of muscle spots between the tubercles, a median basal pale stripe heavily outlined with black spreads towards the tubercles and fades posteriorly, a vague dark spot between the second pair of muscle spots, entire abdomen with scattered long bristles, venter dark with a pair of pale spots anterior to the spinnerets; *legs*, 1–2–4–3, III left missing, all joints pale with broad dark bands, median on femora, basal, median and distal on tibiæ and metatarsi, spines, I pair, femur, dorsal, 3 whorls, ventral, 11 pairs, the 6 spines at the distal end of the prolateral row, very long and strong, patella, 1 at the tip, prolateral, 2, retrolateral, 1, tibia, spines scattered on the dorsal and ventral sides, metatarsus, ventral, 0, II pair, femur, dorsal, in 3 whorls, ventral, a prolateral row of 11 spines, patella same as I pair, tibia, bent, ventral, 4 pairs of strong spines with a curved tip, each from a raised base, III pair, femur, 2 small ventral spines near the base, IV pair, femur, ventral, prolateral row with 4 basal strong spines each from a raised base, retrolateral row only at the distal end; *palpus* not as long as the cephalothorax, patella with 1 long strong bristle, tibia about as long as wide, paracymbium long with a truncate tip, clavis long, with a broad recurved spur from the base, tip extends far beyond the cavity, embolus probably a very small, short black spur near the tip.

Female. Length, 9.0 mm., ceph. 3.2 mm. long, 3.0 mm. wide, abd. 7.9 mm. long, 5.5 mm. wide.

Cephalothorax brown, covered with short white hairs, the pale stripe much narrower than in the male, eye area not carried forward as much as in the male; *eyes* same as in the male; *mandibles* brown, vertical, fang groove oblique, upper margin with three teeth, middle tooth the largest, lower margin with two widely separated teeth; *mouth* parts and *sternum* same as in the male, no spurs on coxæ or trochanter; *abdomen* dorsal tubercles not as distinct as in the male but the markings the same; *legs*, 1–2–4–3, much darker than in the male, spines, femora with 0 ventral spines, I pair, femur, dorsal, small and scattered, 3 strong prolateral spines, patella, prolateral, 2, retrolateral, 1, tibia and metatarsus, spines small and not paired, II pair, tibial spines not modified; *epigynum*, chitinized area longer than wide, a wide spoon-shaped scape, deeply depressed in the middle area with the tip rebordered.

Holotype ♂ Mona Island, August 1944 (Beatty). Allotype ♀ Mona Island, August 1944 (Beatty). Paratype ♂ Mona Island, 6 April 1944 (Serrallés), I pair of legs missing. Paratypes 2♀ Mona Island, August 1944 (Beatty), probably in the penultimate moult.

The genus *Wixia* was based by O.P.-Cambridge in 1882, on the species *abdominalis* known only from the female from the Trail collection from the Amazon. In 1889, he erected the genus *Amamra* in the Biol. Centrali-Americana, 1, p. 55, for five species from Central America. A few years later, in the second volume of the Biol., F.O.P.-Cambridge placed this genus as a synonym of *Wixia* but he gave no reason for so doing.

Wixia serrallesi does not agree perfectly with the definition of the genus as given by F.O.P.-Cambridge. The eyes are the same in both male and female, with the a.m.e. the largest, the clypeus is less than a diameter of a.m.e., instead of very high, the abdominal tubercles are small in both male and female. Eventually, the genus *Amamra* may be revived, either as a distinct genus or a subgenus of *Wixia*, and *serrallesi* would be placed with it, rather than in the genus *Wixia*, which has large abdominal tubercles and the quadrangle of median eyes square.

Wixia serrallesi is very near to *Wixia clivosa* (O.P.-Camb.) known from both male and female from Mexico and placed by O.P.-Cambridge in the genus *Amamra*.

Both have a very long clavis that has a circular sweep outside the cymbium and both have the median area of the scape depressed.

FAM. SALTICIDÆ

Genus *Hentzia* Marx 1883

Hentzia squamata (Petrunkevitch)

Wala squamata Petrunkevitch, 1930, p. 146, figs. 130–134. "several ♂s and ♀s, from Mona Island, 24 February 1914, in the collection of the American Museum of Natural History."

The specimens described by Dr. Petrunkevitch all had the short vertical mandibles. Six males and six females were collected by Beatty in August, 1944. Three of the males have the short mandibles and the others have mandibles of varying length. When the mandibles are long and porrect, the two teeth on the promargin are widely separated, one near the base of the fang and the other near the base of the joint. The large tooth on the retromargin is much nearer the tooth at the distal end, than to the second tooth that is almost hidden by the scopula of the maxillæ. The largest male is 6.0 mm. long with the cephalothorax, 2.5 mm. long and 2.2 mm. wide. The mandibles are 2.0 mm. long, with the outer margins parallel and fringed with long white hairs; the inner margins are touching on the basal quarter and then gradually narrow to the width of the fang. On the specimens with the long, porrect mandibles, the fang is longer than the basal joint with the distal third very slender and curved.

In all specimens of females, the mandibles are vertical, rather thick, with a large bicuspid tooth on the retromargin. A large female is 6.7 mm. long.

The species is very close to *Hentzia peckhami* (Cockerell), 1893, from Jamaica, (*Anoka moneagua* Peckham, 1894). This species is smaller and all of the type specimens of the Peckham species from Moneague, have short mandibles, with no white scales, either on the mandibles or on the cephalothorax. The females are also small and dark. The epigynes are very similar.

Genus *Stoides* Simon 1901

Stoides placida spec. nov.

Figure 4

Female. Length, 3.4 mm., ceph. 1.5 mm., abd. 2.1 mm. *Cephalothorax* dark brown, ocular area covered with golden iridescent scales, a large pale transverse spot, twice as wide as long on slope posterior to the dorsal eyes, probably in life covered with white scales as a few remain on the lateral margins, a few white scales on margin above the posterior legs, clypeus with white scales, cephalothorax very high, widest posterior to the dorsal eyes, in a lateral view, slightly depressed posterior to the ocular area, then sloping very gradually to near the posterior margin where it falls abruptly, thoracic groove very short and faint; *eyes*, anterior row recurved, so that the posterior margins form a straight line, the eyes inclined downward, so they can not be seen from the dorsal view, a.m.e. very large, almost touching, a.l.e about a radius of a.m.e. and separated from them by less than a diameter of a.l.e., eyes of the second row midway between the first and third rows, eyes of the third row subequal with a.l.e. and on the extreme margin of the carapace; *quadrangle* slightly narrower behind than in front and about two-thirds as long as wide; *clypeus* retreating, about two-thirds as wide as the diameter of a.m.e., with a long recurved bristle between a.m.e.; *mandibles* brown, with many white scales, rather small, cone-shaped, fang groove short, no teeth on either margin, fang short with a very thick base; *labium* pale, longer than wide, tip pointed; *maxillæ* pale, one and a half times as long as labium and inclined; *sternum* pale brown, about as long as wide, convex, fourth coxæ almost touching; *abdomen* a broad oval, dorsum flat with scattered scales and white hairs and longer dark hairs or bristles, a short dark basal band, followed by a pale brown median stripe with irregular margins, on anterior half a pair of large brown spots, followed on the posterior half by a pair of darker brown spots, venter pale with three narrow brown stripes, spinnerets pale, long, closely grouped and extending some distance from the abdomen; *palpi* pale, patella and tip of femur with white scales; *legs,* 4–3–1–2, pale, femora with basal and distal dark rings, more distinct on ventral side, posterior tibiæ with basal and distal dark rings, scattered white iridescent scales on distal joints, spines, I pair, no patella spines but a long trichobothria at the tip, tibia, dorsal, 0, ventral, 2 distal, 1–1r, prolateral, 1, metatarsus, dorsal, 0, ventral, 2–2, II pair the same as I pair, III and IV pairs, patellæ with prolateral and retrolateral spines, a dorsal basal spine on tibiæ, tibiæ spiny, metatarsi with three whorls of spines; *epigynum,* the pair of spermatheca separated by almost two diameters, with smaller sacs just anterior which are separated by about a diameter, between the two sacs a depressed area.

Holotype ♀ Mona Island, August 1944 (Beatty).

The genus *Stoides* was based by Simon on *Prosthesima pygmæa* Peckham from St. Vincent. Later the Peckhams added to the genus, *Attus auratus* Hentz, common in the southern part of the United States. It is questionable if the latter species belongs in the genus. The types of *Prostheclina pygmæa,* both male and female, were probably returned to the British Museum and the co-types, an adult female and an immature specimen, retained by the Peckhams and are now in the Museum of Comparative Zoölogy collection. They are old and very much rubbed but probably once had hairs and scales on the cephalothorax. In the female the second row of eyes is plainly midway between the first and third rows as stated by the Peckhams. Simon in the description of the genus, places the eyes of the second row nearer the third than to the first row. *Stoides placida* is congeneric with *Stoides pygmæa* (Peck.). It is slightly larger and has the anterior row of eyes more retreating so that the eyes are not visible from the dorsal side.

Genus *Sidusa* Peckham 1895

Sidusa mona spec. nov.

Figures 5, 6

Male. Length, 4.5 mm., ceph. 2.4 mm. long, 1.6 mm. wide, abd. 2.1 mm.

Cephalothorax dark brown, ocular area covered with white scales with scattered dark bristles, the white scales extend in a long point behind the dorsal eyes half way to the posterior margin, marginal stripe of white scales, cephalothorax moderately high, highest posterior to the dorsal eyes, widest posterior to the dorsal eyes, posterior margin about two-thirds as wide as the anterior, thoracic groove short, in a shallow depression covered with white scales; *eyes* cover about one-third of the carapace, anterior row strongly recurved, a.m.e separated by little more than a line, a.l.e. about a radius of a.m.e., separated from them by less than a radius of a.l.e., second row of eyes midway between first and third rows, third row of eyes slightly narrower than the first row, eyes not on extreme margin, subequal with a.l.e.; *quadrangle* about half as wide as long; *clypeus* slightly protruding, about as wide as a radius of a.m.e.; *mandibles* brown, vertical, rather short, promargin of fang groove with 3 teeth near the median margin, retromargin poorly defined with no teeth, fang with a heavy base, as long as groove; *labium* pale brown, about as wide as long; *maxillæ* pale, about one and a half times as long as labium; *sternum* dark brown, with a few long white hairs, three-fifth as wide as long, first pair of coxæ separated by a little more than a diameter, fourth pair almost touching; *abdomen* oval, covered with short white hairs and longer dark bristles, a pair of wide dark stripes, heavier at the base show beneath the white hairs, venter pale; *legs,* 4–1–3–2, pale, with white scales and longer dark hairs, I pair with a prolateral dark mark on the tibia, IV pair with the femur darker at the tip, spines, I pair, patella, prolateral, 1, tibia, dorsal, 0, ventral, 2–2, followed by 1r, retrolateral, 0, prolateral, 1–1, metatarsus, ventral, 2–2, II pair, patella, lateral, 2, tibia, ventral, 2 distal followed by 1–1r, prolateral, 1–1, retrolateral, 1, metatarsus, ventral, 2–2, retrolateral, 1, III and IV pairs with dorsal basal spine on tibiæ, patellæ with prolateral and retrolateral spines, whorl at the tip of the metatarsi; *palpus* about as long as cephalothorax, femur and patella pale, covered with white scales, tibia and cymbium darker, both with many long dark hairs, tibia but little longer than the patella, about as wide as long, tibial apophysis a long slender spine parallel to the cymbium and almost reaches the tip of the palpal organ, palpal organ small and confined to the basal two-thirds of the joint, embolus a strong black spine with a heavy base and does not extend beyond the cavity.

Female. Length, 5.5 mm., ceph. 2.6 mm. long, 2.0 mm. wide, abd. 3.6 mm. long, 2.1 mm. wide.

Cephalothorax brown, covered with white scales and longer dark bristles in the eye area, widest just posterior to the dorsal eyes; *eyes* same as in the male; *clypeus* covered with white hairs, less than a diameter of a.m.e.; *mandibles* pale brown, vertical, promargin of the fang groove with three teeth, retromargin with no teeth; *sternum* and *mouth parts* same as in the male; *abdomen* oval, covered with white hairs and longer dark bristles, with the pair of broad lateral dark stripes showing under the white hairs as in the male, on the posterior half the dark stripes broken into two pairs of spots, venter pale; palpi pale, covered with white hairs; *legs*, 4–1–3–2, pale with a dark prolateral spot near the tip of the first femur, spines the same as in the male; *epigynum* shows little exterior structure, two lobes with deeply chitinized margins and dark spermatheca near the posterior margin.

Holotype ♂ Mona Island, August 1944 (Beatty). Allotype ♀ Mona Island, August 1944 (Beatty). Paratypes several ♂s ♀s Mona Island, August 1944 (Beatty).

Sidusa mona is closely related to *Sidusa pavida* Bryant, from the Virgin Islands. The former has the tibial apophysis of the palpus much longer and the embolus heavier. Neither belong to the genus *Sidusa* in the sense used by either Peckham or Simon, as there is no tooth on the retromargin of the fang groove and there is a dorsal basal spine only on the posterior tibiæ. But F.O.P.-Cambridge has placed in the genus several of the Peckham genera that eventually may be recognized.

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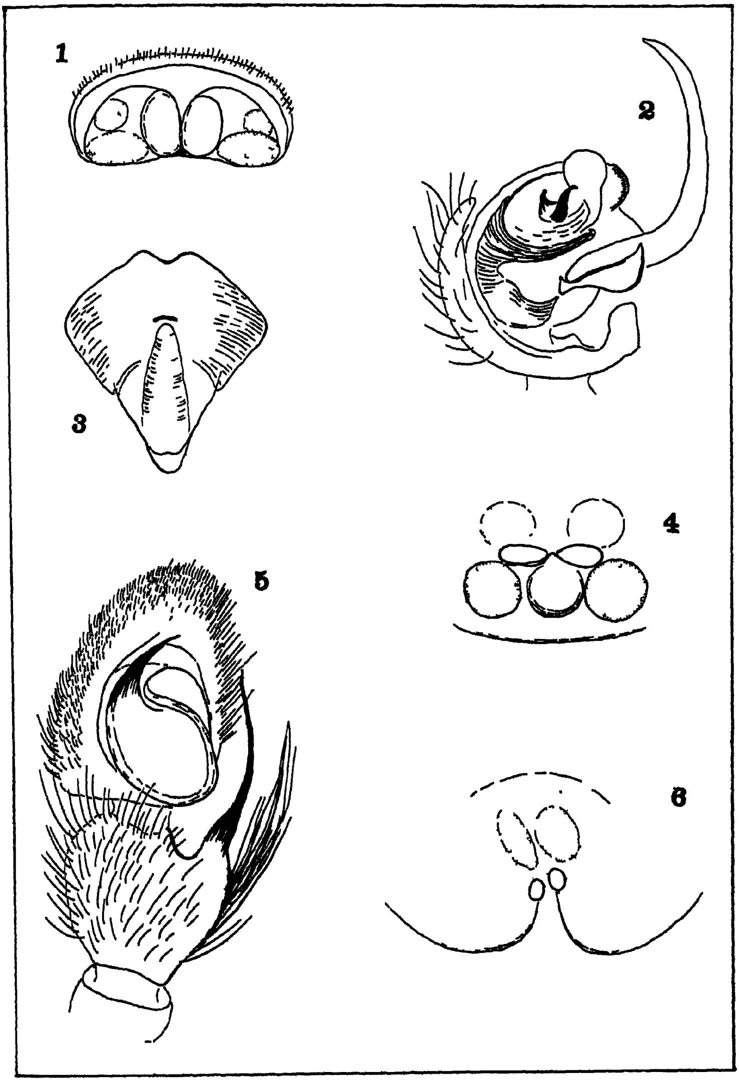
EXPLANATION OF PLATE 4

Fig. 1. *Theridion insulicola* spec. nov., epigynum.
Fig. 2. *Wixia serrallesi* spec. nov., left palpus, ventral.
Fig. 3. *Wixia serrallesi* spec. nov., epigynum.
Fig. 4. *Stoides placida* spec. nov., epigynum.
Fig. 5. *Sidusa mona* spec. nov., left palpus, ventral.
Fig. 6. *Sidusa mona* spec. nov., epigynum.

PSYCHE, 1947 VOL. 54, PLATE 4



BRYANT—SPIDERS FROM MONA ISLAND

TAXONOMIC NOTES ON THE DILARIDÆ (NEUROPTERA)[1]

By F. M. Carpenter
Harvard University

The little-known family Dilaridæ has been represented in the New World by two genera, *Nulema* and *Nallachius*. *Nulema*, which is based upon *championi* Navas (1914), from Guatemala, is very close to *Nallachius* and may turn out to be synonymous with it. *Nallachius* has included seven species from the Neotropical and Nearctic regions. Its genotype, *prestoni* McLachlan, has been inadequately known, the type of the species only recently becoming available for study at the British Museum. In reply to my inquiry about this type, Mr. D. E. Kimmins kindly sent me excellent drawings of its venation and abdomen. On the basis of this information and the examination of specimens of other species in the Museum of Comparative Zoology, I am redefining here the genus *Nallachius*, with a review of the known species; describing a new species of *Nallachius* from Paraguay; and proposing a new genus for one of Banks' species from Colombia.

Navas' grouping of the dilarid genera into two tribes, Dilarini and Nallachiini, was mainly based upon the width of the subcostal space and the number of subcostal veinlets. In all probability, however, the width of the subcostal space is merely correlated with the size of the insect and does not represent a phylogenetic division of the family. On the number of subcostal veinlets Navas was clearly in error, for in this respect not even the genotype of *Nallachius* fits his definition of the genus. He also pointed out that whereas all the Dilarini are restricted to the Old World, the Nallachiini occur exclusively in the New World. This is no longer true, however, for *hermosa* Banks, from Colombia, obviously falls into the Dilarini. In defense of Navas' classification, however, it should be noted that there are certain general differences between the members of the tribes Dilarini and Nallachiini. The former are relatively large, with a wing expanse of 20 mm. or more, whereas the Nallachiini have a wing expanse of less than 10 mm. Furthermore, the wings and antennæ of the Dilarini show much less sexual dimorphism than they do in the Nallachiini. But these are differences in degree and will undoubtedly break down as more species are known. I believe that a more satisfactory and distinctly phylogenetic division of the family might be attained on the structure of the male genital armature and of the media and cubitus of the wings, as in other families of the Neuroptera (Hemerobioidea and Raphidioidea; see Carpenter, 1935, 1940). Some evidence for this has already been obtained and will be presented in a later paper on the Dilaridæ.

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[1] Published by a grant from the Museum of Comparative Zoölogy at Harvard College.

Genus *Nallachius* Navas

Nallachius Navas, 1909, Mem. Real. Acad. Ciénc. Art. Barcelona, 7(17): 665; Navas, 1914, Gen. Insectorum, 156: 11.

Male: antennæ with long pectinations (usually 9–12). Fore wing distinctly triangular, coastal space of moderate width, traversed by numerous branched or unbranched veinlets; subcostal space narrow, with from 2–7 short veinlets; Rs usually with 4–5 main branches; MA always anastomosed proximally with Rs. Hind wing about two-thirds as long as the fore wing; Rs usually with one main branch less than in the fore wing. Genital armature consisting of a transverse proximal plate, two pairs of slender processes extending posteriorly from the plate, and a median ædeagus.

Female: antennæ filiform, as in other female Dilarids. Fore wing: more slender than that of the male, but with essentially the same venation. Hind wing: about two-thirds the length of the fore wing. Venation as in the male.

Genotype: *Dilar prestoni* McLachlan.

Navas' diagnosis of this genus is not entirely satisfactory. His statement that the subcostal space of the fore wings contains almost no veinlets, in contrast to the several veinlets in *Dilar*, etc., is not true; even in the type of *prestoni* there are seven subcostal veinlets. *Nallachius* is undoubtedly a valid genus, however. It differs from *Dilar* and the other Old World genera by the triangular fore wings of the male, the long antennal pectinations of the male, the smaller number of cross-veins in the fore wings, the reduced hind wings of both sexes, the sexual dimorphism of the wings, and especially the male genital armature. It is impossible to give a more precise generic diagnosis at this time because of the few species known in the genus. In addition to *prestoni* the genus includes *americanus* McL., *pulchellus* Banks, *bruchi* Navas, *loxanus* Navas, and *reductus*, n. sp., described below; and of these only *americanus* and *pulchellus* are known (in the literature) by both sexes. Furthermore, in the course of making this study, I have noted that the fore wings of *americanus* (and presumably also of *loxanus*) differ from those of the other species mentioned by having the posterior branch of MP anastomosed with CuA for a short interval. This is a very striking and unusual characteristic to find in the Neuroptera, and may turn out to be of generic significance, when the venation of *loxanus* is known for certain.

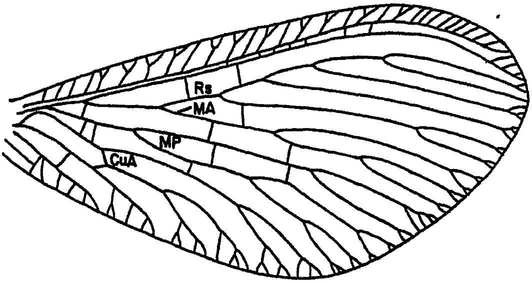

Figure 1. *Nallachius prestoni* (McL.). Drawing of fore wing of the type (♂) in the British Museum (made by D. E. Kimmins). Lettering (original): Rs, radial sector; MA, anterior media; MP, posterior media; CuA, anterior cubitus.

The male genital structures show only slight differences in the several known species of the genus. In all probability they will not be as useful in specific taxonomy as venational details.

Nallachius prestoni (McLachlan)

Figure 1

Dilar prestoni McLachlan, 1880, Ent. Mon. Mag., 17: 39.
Nallachius prestoni Navas, 1909, Real. Acad. Ciénc. Art. Barcelona, 7(17): 667.

I have seen no specimens of this insect, but include here a drawing of the fore wing made from the type (♂, Rio de Janeiro, Brazil) by Mr. D. E. Kimmins, of the British Museum (Natural History). Photographs of the wings of *prestoni* are reproduced in Professor Da Costa Lima's *Insectos do Brasil,* tome 4 (1943), figures 54 and 55. As shown in figure 1, there are seven short cross-veins in the subcostal space, and five main branches of the radial sector (not including MA). The posterior branch of MP is not anastomosed with CuA. Mr. Kimmins also kindly sent me a drawing of the terminal abdominal structures, which closely resemble those of *N. americanus* (Carpenter, 1940, fig. 74).

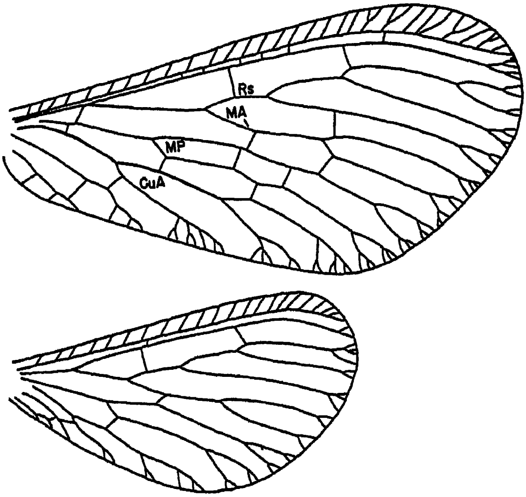

Figure 2. *Nallachius pulchellus* (Banks). Drawing of fore and hind wings of type (♂) in the Museum of Comparative Zoölogy.

Nallachius pulchellus (Banks)

Figure 2

Dilar (*Nallachius*) *pulchellus* Banks, 1938, Rev. de Ent., 9: 289.

Nallachius pulchellus Carpenter, 1940, Proc. Amer. Acad. Arts Sci., 74: 274.

I include here a drawing of the fore and hind wings of the male. The venation is much more open than that of *prestoni*, there being only three main branches to Rs, and less secondary branching of all veins. The posterior branch of MP is independent of CuA, as in *prestoni*. Most of the costal veinlets are unbranched, but this is probably variable in individuals. The male genital armature is surprisingly like that of *prestoni*, though the ædeagus is relatively longer (Carpenter, 1940, fig. 75c).

The types (♂♀) of *pulchellus* were collected at Soledad (Cienfuegos), Cuba, May 4, 1930, and an additional male was recorded by me in 1940 from the Santa Rita Mountains (5000–8000 ft.), Arizona.

Nallachius bruchi Navas

Nallachius bruchi Navas, 1923, Arix. l'Inst. Ciénc. Barcelona, 7: 195.

This species is known only by the female type, from Alta Gracia (Cordoba), Argentina, and originally deposited in the Navas collection. Navas did not figure the wings and I doubt that the species can be recognized from his description. However, it is clear from his account that the posterior media ("procubito") is not anastomosed with CuA.

Nallachius reductus, n. sp.

Figure 3

Male: antennæ very pale yellow and with long pectinations as characteristic of the genus; eyes very dark brown or even black; head and prothorax light brown; legs pale yellow, with dark brown at distal end of tibia. Fore wing: length, 5 mm.; greatest width, 2.2 mm.; relatively more slender than that of *prestoni,* and its hind margin less rounded; membrane hyaline, with numerous faint and irregular gray spots; only a few costal veinlets forked; end of Sc and Rl not so strongly curved as in *prestoni;* Rs (of type) with four main branches; media, cubitus and cross-veins as in *prestoni,* there being no anastomosis between the posterior branch of MP and CuA. Hind wing: length, 3 mm.; width, 2 mm.; broadly oval; costal area relatively broad; Rs (in type) with three main

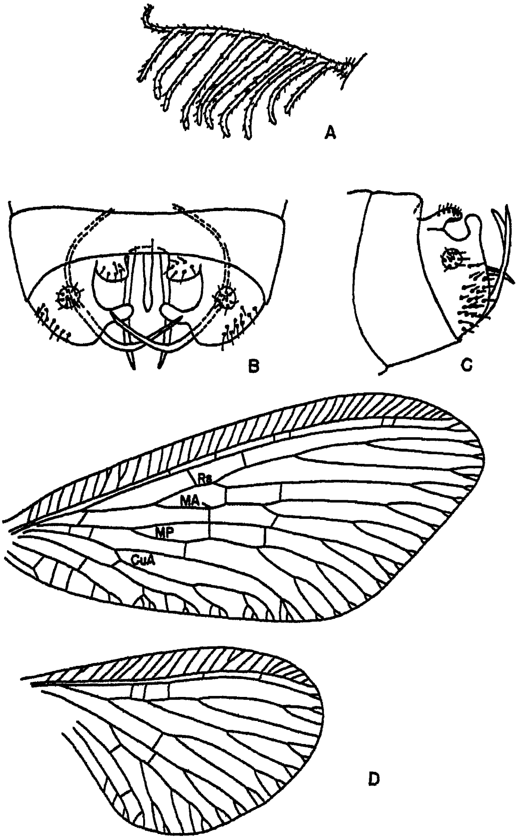

Figure 3. *Nallachius reductus*, n. sp. A, antenna; B, terminal part of abdomen, dorsal view; C, same, lateral view; D, fore and hind wings. All drawings made from the type (♂) in the Museum of Comparative Zoölogy.

branches. Genital armature as shown in figure 3, B, C; ædeagus longer than in *prestoni.*

Female unknown.

Holotype (♂): No. 27664, Museum of Comparative Zoölogy; collected at Ualyaia, Paraguay; October (F. Schade).

This species has much fainter wing markings than *prestoni,* the wing as a whole appearing smoky. The 10th abdominal segment has more pronounced lobes than in *prestoni,* and the ædeagus is shorter. The hind wing is much more reduced than that of *prestoni.*

Nallachius americanus McL.

Figure 4

Dilar americana McLachlan, 1881, Ent. Mon. Mag., 18: 55; Banks, 1905, Trans. Amer. Ent. Soc., 32: 24.

Nallachius americanus Navas, 1909, Mem. Real. Acad. Ciénc. Art. Barcelona, 7(17): 667; Carpenter, 1940, Proc. Amer. Acad. Arts. Sci., 74: 273; Steyskal, 1944, Psyche, 51: 183.

The male genital armature and wings of both sexes were figured in my 1940 revision, but I include here drawings of the wings of the male in order to call attention to the anastomosis of the posterior branch of MP with CuA in the fore wing. The amount of anastomosis appears to be constant in the species. So far as I am aware, this venational peculiarity is unknown in the Old World Dilarids, though it does exist in *N. loxanus* Navas, from Ecuador. If it were not for the striking similarity of the male genitalia of *americanus* and *prestoni,* I would consider this sufficient to separate the two generically. It is noteworthy, also, that there are fewer subcostal cross-veins in *americanus* than in *prestoni.*

The surprising collection of twenty-seven specimens of *americanus* in Detroit, Michigan, has already been noted by Steyskal (1944). The species is now known to occur in Kentucky (type), Maryland, Virginia, and Michigan.[2] In the Museum of Comparative Zoölogy there is also a male from El Yunque, c. 3000 ft., Puerto Rico, May, 1931 (P. J. Darlington). This is an unexpected extension of the range, but careful study of the specimen, including the genitalia, fails to show any differences of a specific nature.

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[2] But not California, as stated by Navas (Gen. Insectorum, 156: 1; 1914).

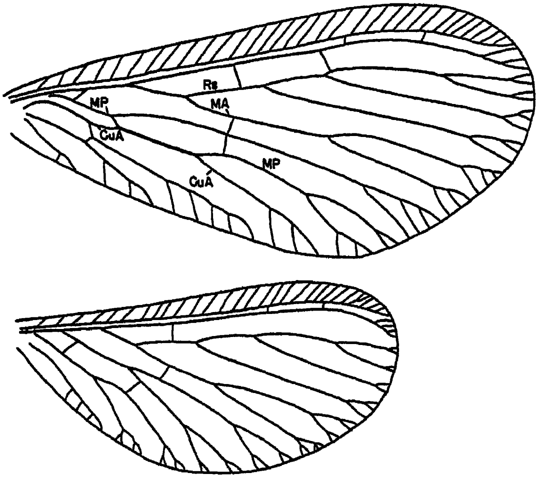

Figure 4. *Nallachius americanus* (McL.). Drawing of fore and hind wings of a male, collected at Detroit, Michigan, June 28, 1944 (Geo. Steyskal), and now in the Museum of Comparative Zoölogy.

Nallachius loxanus Navas

Nallachius loxanus Navas, 1911, Ann. Soc. Sci. Bruxelles, 25: 219.

This is known only from the male type, which was collected at Loja, Ecuador, in 1909, and is now in the Muséum National in Paris. Navas' crudely drawn figure of the wings shows that the posterior branch of the anterior media is anastomosed with the anterior cubitus, as in *americanus*, although the amount of anastomosis is not indicated. According to his drawing, the hind wing is much more slender than that of *americanus*.

Neodilar, new genus

Probably more closely allied to *Dilar* than to *Nallachius*. *Female:* Body structure essentially as in *Dilar* as far as known.[3] Fore wing: short and triangular; venation much as in *Dilar*, the veins with many secondary branches, but with very few cross-veins, and a short anastomosis of the posterior branch of MP and CuA. Hind wing: short and very broad; costal space also very wide. Male unknown.

Genotype: *Dilar hermosa* Banks.

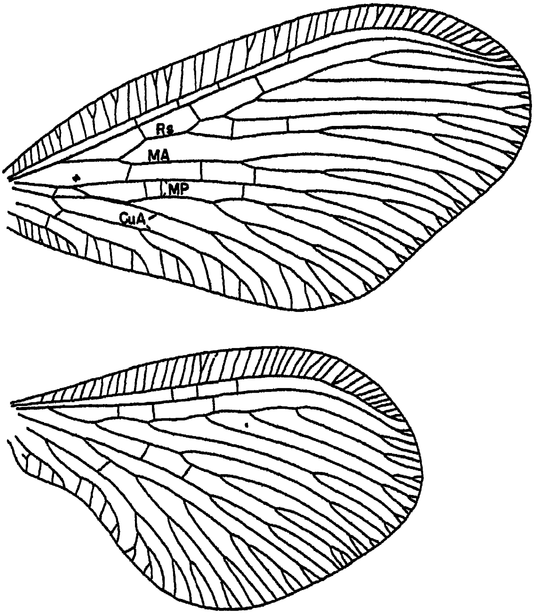

Figure 5. *Neodilar hermosa* (Banks). Drawing of fore and hind wings of the type (♀), in the Museum of Comparative Zoölogy.

Neodilar hermosa (Banks)

Figure 5

Dilar (*Nallachius*) *hermosa* Banks, 1913, Trans. Amer. Ent. Soc. 39: 220.

Banks has given a complete description of this insect, but I include here drawings of the fore and hind wings, which have not previously been illustrated. They show a combination of certain characteristics of *Dilar* and *Nallachius*. The maculations on the wings resemble those of

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[3] The antennæ are broken off in the type of *hermosa*.

N. prestoni in size, being larger than the ones occurring in *Dilar*. The triangular fore wing, short hind wing, the small number of cross-veins and the anastomosis of MP3+4 and CuA are also suggestive of *Nallachius*. On the other hand, the relatively large size (wing expanse, 25 mm.), and especially the very extensive secondary branching of the veins are suggestive of *Dilar*. The latter characteristic is probably the most significant of these, and until the male is found, we may assume the closest affinities are with the Old World Dilarids.

The female type (which is in the Museum of Comparative Zoölogy) is the only specimen of this insect known to me; it was collected at Pacho, E. Cordilleras, Colombia, elevation 6600 ft.

ON SOME ACARINA FROM NORTH CAROLINA[1]

BY NATHAN BANKS
Holliston, Mass.

Among a considerable number of mites collected by Prof. A. S. Pearse at Durham, North Carolina, are some new species and other rare or little known forms. Of particular interest is the rediscovery of Say's *Erythræus mamillatus,* which proves to belong to the genus Labidistomma, not previously recognized in the eastern part of our country. The genus Xenillus, hitherto not noted from America is also of interest; it was described many years ago as a new genus of beetles. The highly specialized group of Gymnodamæini is represented by four species, in three genera, two of which are new. A specimen of the peculiar *Zetorchestes equestris,* described by Berlese from Missouri, is the first in an American collection.

ERYTHRÆIDÆ

Erythræus exilipes sp. nov.

Figs. 30, 35

Body nearly two and one-fourth times as long as broad, broadest just above third coxæ, a little before middle of length, front margin nearly straight across, two eyes each side, about diameter apart, median groove about one-half as long as front margin. Body covered with stout, sharp-pointed spines, rather long, and mostly erect; many, when magnified, are seen to be covered with minute sharp spicules. Legs also with bristles, those on coxæ about as coarse as on body, but beyond becoming finer, and mostly appressed, those on the under side of the last joint of front legs very fine and short.

Legs long and slender, all tarsi swollen. Front legs nearly twice as long as body, the third joint from tip (tibia) about as long as greatest width of body, tarsus about two-thirds of protarsus; second pair of legs but little longer than body; the tarsus about three-fourths of protarsus; third legs plainly longer than second pair, tarsus about two-thirds of the slender protarsus; fourth legs fully two and one-half times as long as body, and very slender, the femora and tibia about equal in length, and each longer than width of body, the protarsus still longer, the tarsus not one-half of protarsus.

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[1] Published with a grant from the Museum of Comparative Zoölogy at Harvard College.

Palpi of moderate length, the third joint swollen, the sides convex, the fifth with stout, apical claw, the lower edge showing about five small, short teeth; the thumb strongly clavate, reaching beyond claw, and with many stiff bristles.

Length of body 1.8 mm.

One from litter in Duke Forest, Durham, N. Car., 7 July (Pearse). Several young ones, of possibly the same species, taken at same place in July and August; these have very tenuous long legs.

The length of the legs, and proportions of the joints thereof will separate the species from allied forms with such long hind legs. Type M.C.Z. Arachn. 3022.

Erythræus carolinus sp. nov.

Figs. 1, 11

Body reddish, legs pale; body fully two-thirds as broad as long, broadly rounded; above with many erect, stiff, simple bristles, as broad at tip as at base, each about twice as long as the width of a femur.

Palpi not one-half the length of front tibia; all legs long and very slender, tarsi enlarged; front femora as as broad as body at third coxæ, the second pair a little longer than body, first pair more than twice the length of body; femur two about one-half of femur one; last joint of front legs considerably enlarged, broadest before tip, more than one-third the length of front tibia. Last joint of second and third legs not as much enlarged. Some of the hairs on legs are bristly on one edge. First and second pairs of legs well separated from the third and fourth.

Front margin of body concave, the corners over the base of front legs projecting slightly, and with three circular pits, and from each a hair, one short and somewhat clavate.

Length 1.4 mm.

One from Duke Univ. Forest, Durham, N. Car., 23 Sept., 1944 (Pearse). Type M.C.Z. Arachn. 3023.

ORIBATIDÆ

Oribatella carolina sp. nov.

Figs. 2, 8

Pale yellowish, edges of the lamella, edges of the square at base of cephalothorax, and the edges sloping back from each side dark brown; legs pale, almost hyaline. The cephalothorax is nearly as broad at base as long, the line of separation from abdomen crosses just above the square, a fainter line crosses the square. The square is partly open in front to a slender triangle which separates the bases of the broad lamellæ, which, beyond this triangle, appear united into one and extend to near tip of the cephalothorax, where there are two points near each other and each tipped by a short spine, the outer edge of each lamella is dark, at first slightly, evenly outcurved until halfway to the tip of cephalothorax and here the dark margin separates and projects forward in a slender, very sharp spine. Each side, a little lower down, is a lateral plate or lamella, nearly hyaline, about two-thirds the length of cephalothorax, and with a nipple-like tip, this may be the lateral part of the principal lamella, and the dark ridge, ending in a long spine, may be a ridge across the lamella.

Each side of this lower lamella is seen the edge of the tectopedium, this is very long. The submedian bristles are thick, slightly roughened, very long, with a slender pointed tip, and arise from just in front of the clear triangle which separates the lamellæ at base; the superior bristle is a very fine and extremely long hair, arising just in front of each anterior corner of the square; the seta is long, curves forward much as in *O. plummeri,* is thickened only near end which is roughened.

The abdomen is plainly longer than broad, the sides but little curved; the wing does not extend in front of the abdomen, is not very broad, and behind merges gradually into the outline of abdomen. On the venter the genital opening is mostly in front of hind trochanter, bilobed behind, almost as long as broad and fully twice its length in front of the smaller, nearly circular anal opening, which is nearly its length in front of the hind margin of venter.

The legs are very slender and short, with few hairs except on the tarsi.

Length .22 mm.

From the Duke Forest, Durham, North Carolina, 2 Dec. (Pearse). Type M.C.Z. Arachn. 3021.

Alloribates gen. nov.

Goes in the Ceratozetinæ, related to Ceratozetes and Peloribates but differs in the structure of the front tarsi. The anterior border of the abdomen bulges forward over the hind part of the cephalothorax so that the origin of the setæ is plainly behind it. On each side of cephalothorax is a lamella reaching from near base of seta almost to the tip of head, it is rather close to the side margin all the way along, but at tip turns inward. Its highest part is toward the base. The wings are about as in Ceratozetes, the ventral openings are far apart, the setæ are quite long; legs of moderate length to short, the front pair extending in front of head, the femora and tibiæ are rather broad, but not strongly swollen. In the front legs the tibia extends over base of tarsus and ends in a long bristle, the tarsus is not quite as long as the tibia, its tip broadly truncate, and with one claw; on the upper side before tip of tarsus there is a cusp bearing a stout, curved bristle.

Alloribates singularis sp. nov.

Figs. 24, 25

Dull yellowish brown, legs paler. Abdomen nearly twice as long as broad, the sides in middle nearly parallel. Cephalothorax very short in middle, near each side margin is the long lamella, no visible hair at tip; setæ hardly as long as their distance apart, the tip fusiform, moderately swollen, and slightly scabrous; just in front of the suture are the two short, superior bristles, not far apart.

No hairs on abdomen; wings several times longer than broad, their lower edge (seen from below) rolled toward body. Genital opening small, twice its length in front of the much larger anal opening.

Legs short and fairly stout, upper side of second coxal bar reaching the genital opening, other bars shorter, and hind border of hind coxæ scarcely noticeable. Femora and tibiæ stout, but sides little rounded, tarsi tapering, except in front leg where it is broadly truncate, with a cusp on its upper side, bearing a curved stout bristle.

Length of body .36 to .42 mm.

Several specimens from Duke Forest, Durham, N. Car., numbers 475, 385, 238, 514, and March–April. Type M.C.Z. Arachn. 3020.

Minunthozetes angusta sp. nov.

Figs. 37, 38

This is a more narrow species than the European type of the genus. The cephalothorax is about one-half as long as the abdomen; the lamella is a low, even, ridge arising close to the base of the seta and sloping forward to its fellow, not far behind the tip of head, the two lamellæ connected by a short translamella, similar to the lamella; apparently there is no hair at tip of lamella, nor noticeable superior bristles; on each side near side-margin is a short straight ridge, the lateral lamella. The seta is short, not reaching laterally beyond the legs, the basal two thirds slender and curved back, the apical third swollen, fusiform, and almost pointed at tip.

The abdomen is nearly one and one-half times as long as broad, for some distance the sides nearly parallel, broadly rounded behind, no hairs, the wings long and slender, base truncate, seen from below, the edge is inrolled for nearly one-half of length.

Legs rather slender, but not long, front tarsus simple, one claw; tibia with a long apical bristle, its tip extending slightly over tarsus, femora somewhat thicker, hind femora short and thick, truncate at tip, the patella attached to upper tip. Genital opening a little broader in front than long, about one and one-half its length in front of the much larger anal opening, latter wider behind than in front, which is slightly bilobed, borders of coxæ three distinct, but no evident hind border to hind coxæ.

Length .3 mm.

From Duke Forest, Durham, N. Carolina (Pearse), numbers 475, 433, and 238. Type M.C.Z. Arachn. 3019.

Tribe ORIBATINI

This tribe, which includes typical Oribata (Damæus), Belba, etc., may be divided into two sections, those with the front tibia normal (Oribata, Belba, etc.) and those in which the front tibiæ are extended over the base of the tarsus, and the tarsus shortened. In this collection are three genera which belong to this second section; they can be tabulated as below.

1. Abdomen about as broad as long, sides rounded; tectopedia not behind but beneath second trochanters; legs not slender, most joints without any swollen part; rather broad, patella narrow on short apical part, sides of tibiæ parallel; the claws borne on a stalk to tarsus *Allodamæus*

   Tibiæ narrowed at base, patellae with parallel sides; abdomen broader than long, claws not on a long stalk; tectopedia behind second trochanters just as behind first trochanters 2

2. Sides of abdomen nearly parallel, legs very long and slender, much longer than entire body; ventral openings united, borders of second and third coxæ nearly reaching middle of venter *Gymnodamæus*

   Sides of body convex, legs scarcely as long as body; ventral openings well separated, borders of second and third coxæ not reaching half-way to middle of venter *Jacotella*

Jacotella gen. nov.

This is based on a small, short-legged species described as *Gymnodamæus quadricaudiculus*[1] by Jacot. Instead of the extremely long and tenuous legs of the typical Gymnodamæus the legs are scarcely longer than body, and not especially slender; the ventral apertures are well separated; there is a strong tectopedum behind first and second trochanters.

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[1] Jour. N. Y. Ent. Soc., 45: 356, 1937.

Jacotella quadricaudicula Jacot
Figs. 3, 15

One from Duke Forest, Durham, N. Car., 25 Nov. (Pearse). It was described mostly in comparison with a European species, *Gymnodamæus austriacus,* so I have given figures (3 and 15) of the venter and legs.

Gymnodamæus Kulczynski

Ewing, in 1917,[2] erected a new genus, Heterodamæus, and included in it his *Damæus magnisetosus;*[3] but unfortunately Ewing selected as genotype the European *Damæus bicostatus* Koch, a species which Kulczynski, some fifteen years before, had selected as type of Gymnodamæus. Thus Heterodamæus becomes a synonym of Gymnodomæus. Jacot[4] says that Kulczynski[5] assigned no type; however he is entirely wrong, for on page 43 of Kulczynski's paper is the statement "Typus *Gymnodamæus bicostatus* Koch."

Gymnodamæus pearsei sp. nov.
Figs. 16, 27

Dark reddish brown, border of abdomen appears black. Shape of body as in genotype, *bicostatus,* plainly longer than broad, not narrowed behind. Two tiny hairs near tip of head, and a longer one each side a little further back. Setæ about as long as the space separating them, swollen toward tip, but the tip sharp. Legs extremely slender and very long, as in the long-legged Oribata. The front and hind femora have rather long basal stalk, then suddenly much enlarged, then tapering to the long slender apical part, this apical part is longer in front femora than in the hind pair; patella one about one-third of tibia, both no wider than the slender part of femora, except in the front pair where the apex of tibia is broadened where it overhangs the base of tarsus; each joint with two long hairs in usual plan; trochanter of hind legs long and but slightly swollen, that of third legs much swollen and short, the femora with a short stalk before the swollen part, thence equally slender to the tarsi which are a little more swollen on basal part. The ventral apertures are on apical half of venter and united, the genital a little the longer; there is a dark transverse line in front of the genital opening, and from each end a faint line curves out to the margin, on each side, opposite the genital opening, is a curved dark mark; the hind borders of second and third coxæ almost reach the middle.

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[2] Ann. Ent. Soc. Amer., 10: 123, 1917.
[3] *Ibid.,* 129.
[4] Bull. 121, B. P. Bishop Mus., p. 18, 1934.
[5] Acad. Litter. Cracoviensis, 42, Ser. B; 43, 1902.

Length of body .5 mm., of hind leg .9 mm. ·

Several specimens from Duke University at Durham, North Carolina, 1 Sept., 14 Oct., 25 Nov., 10, 24 Febr., and 21 April (Pearse). Type M.C.Z. Arachn. 3012.

This species is separated from Ewing's *Damæus magnisetosus,* by the very much longer front tibia and the longer hind femur; *magnisetosus* moreover has a nearly circular venter, the legs are broader, the granulations coarser, the tarsi more slender at base.

Gymnodamæus minor sp. nov.

Figs. 28, 39

The color is yellowish; about two-thirds the size of *G. pearsei;* the body is a little more slender, and the legs are not quite so long. The cephalothorax is similar but the hair at each side of tip of head is more clavate, the seta is similar, the tip long, fusiform, and scabrous. The first legs are not quite as long as the body, the femora bulbous close to base, before middle faintly sinuous, patella nearly as long as bulb of femur, the tibia becoming broader to the swollen tip, the tarsus attached as in *G. pearsei,* the tarsus is proportionally more swollen than in *pearsei,* hairs similar, but the one at tip of tibia apparently not as long as in *pearsei.* The fourth legs about equal to length of body; the femora are bulbous quite close to base, so that the stalk of femur is extremely short (much longer in *pearsei*). The tarsus is fusiform, quite hairy toward tip. On the venter the apertures are separated slightly more than in *pearsei*, but connected by a dark, chitinous area; the outlines of coxæ are not visible, only at margin is a dark circle at base of leg three and four. Coxæ one and two are separated by an oblique bar, not reaching one-half way to middle, at tip of abdomen are three hairs each side, all short, but one is much longer than others, and curved almost in a circle.

Length .35 mm.

From Duke Forest, Durham, North Carolina, in January, March and April, numbers 238, and 505. Type M.C.Z. Arachn. 3013.

Readily separated by the very short stalk to the hind femora, as well as size, color, apical hairs of abdomen, etc.; also separated from *Damæus magnisctosus* Ewing, by the more slender and less coarsely granulose legs; the front tibia is similar in length to that species, but the tarsus is narrow at base and swollen in middle; the abdomen of *magnisetosus* is much broader, nearly circular, the hind femur of Ewing's species has the hind femur swollen in middle with a short stalk at each end.

Allodamæus gen. nov.

In appearance this resembles a Belba, but the second tectopedia are present, but bent under the second trochanters and so not noticeable from above. The abdomen is as broad as long, broadly rounded, the ventral openings are separated by a short space. The legs are of moderate length, much as in Belba; in the front legs the tip of the tibia extends over the base of tarsus much as in Gymnodamæus, but more broadly. The tarsus, instead of gradually tapering to a fine point, is abruptly narrowed some distance before tip, thus the claws are attached to a long, slender stalk that has the appearance of a separate joint. The legs, of moderate length, are not especially slender, nor scarcely swollen on any joints, except the trochanter (like Ewing's figure of *Damæus magnisetosus*). However in essential characters it belongs in the Oribatini, near to Gymnodamæus.

Type is *Allodamæus ewingi* n. sp.

The nymph of this or some allied species has two long, curved setæ at tip of abdomen (figure 6).

Allodamæus ewingi sp. nov.

Reddish brown to dull yellowish brown; there is a pulverulence over the legs which has the appearance of equally short erect hairs on each side of each joint; it is also over the front of head. The fine hairs on the legs are, at first, scarcely noticeable, a much stouter hair arises from near tip of third trochanter. The tectopedium behind first trochanter has a tooth on outer side. The ventral openings are but little separated, the anal slightly the longer, the genital almost its length from the transverse bar at base of abdomen, the anal opening is nearly one-half its length from the end of venter. Above on the cephalothorax at each basal corner is the base of the seta, but no seta is visible unless it is very short and capitate; a little in front arises the superior bristle, which near tip is somewhat thickened.

The front legs are nearly as long as width of the abdomen, the hind legs as long as the entire body. The base of the patella and tibia is suddenly broadened, like a basal collar to the joint, the patella is much narrowed beyond the collar, but the tibia continues broad to the attachment of the tarsus, and in front legs the upper tip of tibia is extended in a point over fully one-half of the thick basal part of tarsus, the tip of the tibial projection has a very long hair.

Length .7 mm.

From the forest of Duke Univ., Durham, North Carolina, 1 Sept. (Pearse). Type M.C.Z. Arachn. 3014.

Oribata carolinensis sp. nov.

Figs. 41, 42

Cephalothorax plainly narrowed a little in front of first legs, a curved anterior bristle each side near tip, and one on each side margin near tip, seta fully equal to length of cephalothorax, whip-lash type, the lash very fine and delicate. Abdomen nearly as broad as long, with a row of curved bristles toward each side, six shorter incurved bristles at tip; ventral apertures touch, the genital nearly circular, the anal nearly as long as the genital, but only about two-thirds as broad.

Legs slender, all tarsi long; fourth legs much longer than body, the first legs almost as long as body, the stalk of femur curved and nearly as long as the swollen part, the patella about one-half the tibia, latter (from side) much swollen, fusiform, tarsus with bulb-like swelling near base, the tapering part nearly equal to tibia plus patella. Hind legs with trochanter nearly one-half of femur, latter with stalk nearly one-half of length, swelling fusiform; tibia a little longer than femur, very slender, except a triangular swelling near tip, tarsus little, if any, longer than tarsus of first legs, a swelling near base, tapering to tip. Most of the hairs on legs are slightly curved and minutely pectinate. Second legs much like first, but shorter, third legs much like fourth, but much shorter, the tibia slightly thickened toward tip.

This species is near to *O. longiseta* Bks., but in that species the hind tibia is not nearly as long as tarsus, and latter not so bulbous near base, the hind tarsus plainly longer than front tarsus, the hairs on legs not so plainly pectinate, on abdomen the hairs are short and straight, and on venter the genital aperture is plainly separated from the anal, and not so nearly circular.

Length .55 mm., hind leg .8 mm.

From Duke Forest, Durham, North Carolina, March–April (Pearse coll.). Type M.C.Z. Arachn. 3010.

Oribata diversipes sp. nov.

Figs. 31, 33

Cephalothorax much narrowed in front of first legs, the sides there scarcely curved, just behind head the cephalothorax is much broadened, then narrowed, and then curving outward for second legs, then much narrowed to base; there is a stout, blunt, curved tectopedium behind both first and second legs, stigma about twice its diameter from margin, the seta long, with a fine whip-lash tip; each side of head near tip are two rather long, curved hairs.

Abdomen globose, four short curved hairs at tip, probably some hairs on dorsum, but the dorsum is cracked and rubbed so I see but two bases for hairs. Venter with openings a little separated, but connected by a narrow median ridge, the genital aperture nearly circular the anal more pear-shaped, behind nearly as broad as the genital, but much narrowed in front, broadly separated from the hind border of abdomen.

Legs long, all tarsi long and fine; first legs equal to length of body, femora, tibiæ and base of tarsi swollen about as much as in most species; the second legs a little shorter, the third nearly as long as body, both with distinct swellings though smaller than on first legs, hind legs very much longer than body, fully one and one-half as long, the tibia plus tarsus equal to body, the swellings are very like *angustipes* and that on femur is longer than usual. Most of the hairs on legs are curved, one on tarsus is very long and nearly parallel to tarsus, on the tip of hind tibia is a long, diverging hair with a fine curved tip, much like those of *grossmanni,* and some others. On the second trochanter is a long hair curving forward, a much shorter one on first trochanter.

Length .5 mm.

One from Duke Forest, Durham, N. Car., March–April (Pearse). Type M.C.Z. Arachn. 3009.

Belba inæquipes sp. nov.

Figs. 32, 43

Body and legs pale yellowish. Cephalothorax more than one-half the length of abdomen, latter rather short and broadly rounded behind; no tectopedia behind first legs, a prominent spike-like one behind second legs, also in front and behind base of third legs is a small projection. The seta is long and with a whip-lash tip as in *B. florida.* The abdomen is strongly convex, with a row of bristles on each side, and six shorter ones on hind margin near tip; the venter is nearly circular, the openings are subequal and rather close together. The legs show definite bulbous swellings on femur, tibia and tarsus, all tarsi very slender and long. The front femora have the swollen part but little longer than the curved stalk; the tibia is strongly swollen, with a fairly long stalk, the tarsus also has a distinct thin stalk before the bulb, the part beyond long and tapering. The hind legs are about as long as body, the trochanter very long, nearly or quite as long as the femur, latter swollen in middle, tapering each way to the short stalk, the tibia has a less swollen part at tip, with a stalk more than twice as long, the tarsus has a short stalk before the bulb, a long and very slender part beyond. The third legs have the very long tarsus, but the tibia is only about one-half of tarsus. The legs are not especially hairy, the long hair of front tibia much before tip and scarcely longer than the joint.

Length of body .4 mm.

Two specimens from Duke Forest, North Carolina (Pearse), #238, January, and March–April. Type M.C.Z. Arachn. 3011.

The mite, at first, with very long hind legs resembles *Oribata angustipes,* the front legs, however, are very different, and in the hind legs the femur is much shorter than in *angustipes.*

Oppiella apicalis Jacot
Figs. 14, 17

The specimens from Duke Forest have the tip of cephalothorax more acute than in the typical form. The seta shows a head distinctly longer than in Jacot's fig. 4, with a few short hairs near tip, possibly others toward base. Probably it will be best to consider the subspecies of *O. corrugata* which Jacot describes, *apicalis, squarrosa,* the form mentioned by Jacot from Great Falls, Va., and the one figured here as only some of the forms of a variable species, *Oppiella apicalis* (which has precedence).

Autogneta amica Jacot
Figs. 19, 21

One specimen from Duke Forest, Durham, N. Car.

The legs are short and slender; the base of the tarsus is sunk into the concave apex of the tibia in all legs, but most strongly in the front legs where the upper end of tibia extends nearly over the basal half of tarsus and is tipped by a long hair; the slender stalk of the tibia is curved in all legs; all of the tarsi are very hairy on apical half, and the claw is very long; all patellæ are very short, and the tip of femur is lobed on each side.

The cephalothorax is narrowed at base and widest at base of the first tectopedia. A little in front of each basal corner is a large, rounded scar, from its anterior inner corner arises a ridge which curves inward and then extends forward parallel to its fellow for fully three-fourths of length of cephalothorax. From the anterior outer corner of each scar arises the long seta, tipped by an elongate swelling; superior bristles apparently lacking, but the round insertion is seen opposite the turn of the ridge.

The abdomen, not twice the length of the cephalothorax, is broadest behind the middle. On the venter is a strong division and constriction between the cephalothorax and the abdomen, there is but little indication of coxal limits, but the second (apparently) is a broad plate separated from its fellow by a somewhat triangular outline, a faint curved line crosses just in front of genital opening and slopes backward to indicate hind border of the fourth coxa.

The genital aperture is broader in front than behind, the anal opening much larger, and fully one and one-half its length from the genital opening. *Dolicheremæus rubripes* Jacot, Florida Entom., 1938, is very similar in general appearance to this species, the body is more slender.

Carabodoides retracta sp. nov.

Figs. 9, 29

Cephalothorax fully as broad at base as long, abdomen about one and a third times as long as broad, broadly rounded behind. Seta spatulate, the broadened tip flat, with rounded outer tip. The cephalothorax above has irregular low, narrow ridges, one starts from close to the stigma, extending obliquely forward and inward, then turns to run parallel to outer margin of cephalothorax.

The legs are short and stout the femora especially thick. In the front legs the tibia is cup-shaped, its tip nearly as broad as its length, this tip is concave and the basal part of tarsus is retracted within it, the tip of tibia above has a long hair. The short tarsus is suddenly narrowed from above and here there are a few hairs. In the hind legs the femora are broad, shouldered, subtriangular, the hind tarsus about equal to tibia, its tip scarcely reaching tip of abdomen. The front legs are hardly as long as width of abdomen.

The genital aperture almost touches the anal, is broader in front than the anal, but behind is a little more narrow than anal, latter is fully as long as genital, but quite narrow in front and fully twice as broad behind.

Length .55 to .6 mm.

From Duke Forest, N. Carolina, numbers 475, 238. The front tibia is more modified than in *apicalis* or *sacchariomycetoides*. Type M.C.Z. Arachn. 3018.

Eremobelba gracilior Berlese(?)
Figs. 10, 23

Related to *E. flagellaris,* smaller, abdomen more elongate. Cephalothorax with two fine linear carinæ in middle, at first parallel, then each turns outward, stigma close to base, hardly its diameter from outer margin; seta long, slender, ending in a fine whip-lash. Above the base of leg one is a shorter carina, reaching forward of lateral margin.

Abdomen nearly one and one-third as long as broad; the anterior lateral margin appears heavier (as in Berlese's figure) with hairs about as in figure but not all distinct in this specimen; four on hind margin, and a submarginal row, and an apparent oblique row.

On the venter the triple U-suture across base of the camerostome and ending at tectopedial spines is very distinct. The genital aperture is a little longer than broad, hardly one-third its length in front of the larger anal aperture, which is broader behind, and separated from hind margin almost as far as from genital aperture.

The legs are finely granular and more slender than in *flagellaris,* especially the tarsi beyond the swelling; the bulb at tip of front tibia is plainly a little broader than long, and almost touches the swelling on base of tarsus; the hind femora are plainly pedicellate, and all patellæ are quite long; the tarsi are very hairy.

Length .4 mm.

From the Duke Univ. Forest, Durham, N. Car., numbers 238, 487.

From the fourteen words of description of Berlese it is hardly possible to recognize this species, but the figure agrees in several particulars. However, the most characteristic points in the legs are not given, since the legs were not figured. His figure shows a long simple seta, but it is possible that the whip-lash tip was lost.

Zetorchestes equestris Berl.

Fig. 26

One specimen from Duke Forest; it is apparently rare; I had never seen it, and none in the Jacot collection.

The body is broadly rounded except in front, where it comes to a point. The first three coxæ are close together in front, the hind coxæ situated much further back. Hind legs much longer and stouter than the others, with a spine at tip of tibia, and two on outer edge of tarsus. Ventral openings connected by borders, the anal much the larger, broadest toward rear, genital not nearly so long and about two-thirds as broad, more than its length behind the third coxæ. Tarsi of front legs rather slender, nearly twice as long as tibia. Above the cephalothorax has a lateral dark lamella on outer side, two-thirds of length of cephalothorax. The seta is paddle-shaped, a slender stalk and a large flat ovoid tip, somewhat lined and with numerous minute points.

Length .4 mm.

Xenillus occultus sp. nov.

Figs. 5, 7

Dull brownish rufous; surface very minutely roughened; body about two-thirds as broad as long, broadly rounded behind, and there with a few erect hairs, each with the tip slightly enlarged, four each side projecting beyond abdomen, and three or four others each side toward tip. Cephalothorax with two elongate, incurved plates (fig. 7), broadest before tip where they almost meet, tip broad, concave, the outer point more prominent, each plate bears a long, roughened, stout bristle from middle of the tip; tip of head with a short, curved bristle each side; at base of the cephalothorax a fairly broad transverse area is delimited and from each upper corner arises the subbasal bristle, enlarged at tip; each seta is nearly as long as this bristle, clavate at tip; each first tectopedium is enlarged and projects laterally, with a sharp outer point anteriorly.

Legs slender, fairly short, joints but little swollen, three equal claws; first legs about length of body, patella nearly one-half of tibia, but few hairs, a long one at tip of tibia above, one, nearly as long, from tarsus before middle, elsewhere but few short hairs; second and third legs hardly width of body; the fourth legs scarcely reach the tip of body.

On the under side are three parallel cross-bars; one at base of first coxæ, one at base of second coxæ, the third, more curved passing behind third coxæ and reaching nearly to fourth coxæ; in the middle this cross-bar is confluent with the curved bar from fourth coxæ, which touches almost the half of genital aperture; the latter is a little longer than broad, scarcely truncate behind.

The anal aperture is twice as long as the genital and situate about one and one-fourth its length behind the genital aperture in the female, fully one and one-half its length behind in the male.

Length of female .7 mm., of male .55 mm.

Two specimens from the Duke Forest, North Carolina. Type M.C.Z. Arachn. 3024.

Eremæus politus sp. nov.

Figs. 20, 22

Pale yellowish. Cephalothorax plainly longer than broad, narowed in front of first legs, in middle with two slightly curved and parallel carinæ; first legs far in front of second, the stigma more than its width from side, behind is a transverse ridge, narrow through the middle, widened behind and beyond stigma, setæ longer than distance between their bases, the head long, and slender, scabrous. A tectopedium behind coxæ one, and also two, the latter rather complicated.

Abdomen fully one and one-half times as long as broad, sides but slightly convex; on each side of the basal part is a short strip of granules. The genital opening plainly longer than broad, about its length in front of the larger anal opening, latter narrow and faintly bilobed in front, more than twice as broad behind. The fourth pair of legs considerably behind the third; the side of the venter between these two pairs is convex, the hind coxæ occupying most of the area, and strongly curved behind. Legs short and stout, with but few fine hairs, almost wholly on tarsi, three claws; all femora thickened, front ones strongly so, and with a ridge or lamella below, tibia short, little if any longer than tarsus, front tarsus from side slightly swollen; hind legs reach nearly to tip of abdomen.

Length of body .4 mm.

From Duke Forest, N. Car., numbers 475, 433, 514. Type M.C.Z. Arachn. 3017.

Epilohmannia elongata sp. nov.

Fig. 40

Pale yellowish brown, legs almost colorless. Body slender as usual, somewhat broadened in middle of abdomen; above without evident hairs; seta short, with clavate tip. The head in front is almost in a point; tip of abdomen broadly rounded. Front legs a little heavier than the others, tarsi quite thick and with a number of rather short hairs, one claw; tibia very broad, rounded on each side, a long hair a little before tip; the third joint before tip (patella?) longer than other joints, narrow on base, but much broadened before tip, scarcely as broad as tibia, second and third legs shorter, about as long as the greatest width of abdomen, the second, third, and fourth joints narrowed on base; fourth leg much longer, reaching to tip of abdomen; first visible joint (trochanter?) very long and extended on outer side at tip over base of next joint, next three joints subequal, narrowed on base, tarsus slender and longer than the preceding joint, all tarsi with a few hairs, the claw very large. Hind coxæ much broadened toward tip, together showing a deep median excavation behind.

The genital opening is situate the length of its base from the base of this excavation; it is roundly broadened behind to a width equal to its length, and here there is a line reaching almost across venter, and crossed by a sloping longitudinal line extending back to middle of anal opening. Anal opening not quite half its width behind the genital, its sides rounded, and slightly narrowed behind, its length plainly a little less than the genital opening. Surface of venter around genital opening shows numerous well-separated granules, and also many down the middle of genital covers, the margins free of them. The second coxæ are very broad, the third much narrower, especially on base; the first coxæ are triangular, the pointed base not reaching middle.

Length .35 mm.

One from the Duke Univ. Forest, Durham, N. Car., 21 Oct. (Pearse). Type M.C.Z. Arachn. 3016.

Lohmannia brevipes sp. nov.

Figs. 34, 36

Body a little more than twice as long as broad, sides of abdomen nearly parallel, tip broadly rounded, tip of head rounded, a fine hair each side; the superior bristles are barbed, and situate close to base of seta, latter is a hyaline scale truncate at tip. On each lateral edge of abdomen are six bristles or scale-like hairs, the first four are barbed or roughened bristles, the first bristle near base of abdomen, second about opposite base of genital opening, two others further behind, and nearer together, beyond are two broadened, or scale-like hairs with barbed edges, the last close to tip of abdomen; above on abdomen, not far from margin, is a row of four shorter, also roughened bristles, the first and second close to the first and second marginal bristles. The genital aperture much more narrow than the anal, and a little shorter, its sides nearly parallel, each cover with about nine hairs as in figure; the anal opening connected to the genital, the sides are curved outward, the covers not occupying available space, and each cover with a row of four barbed bristles.

The legs are very short and stout, the front pairs heavier than others, the femora are narrowed at base, and the tibiæ are concave on inner edge, there are some hairs chiefly on tarsus, some on the hind legs are barbed hairs, and also some on outer side of femora one and two are broadened scale-like and roughened; the single claw is very long, the curve mostly near tip; a long hair at tip of tibiæ.

Length .28 mm.

Several specimens from Duke Univ. Forest, Durham, N. Car., 21 Oct., 4, 25, Nov. (Pearse). Type M.C.Z. Arachn. 3015.

LABIDOSTOMMATIDÆ

Labidostomma mamillatus Say (*Erythræus*)

Figs. 4, 12, 18

Say's species has not been recognized previously; Jacot suspected it might belong to Labidostomma, but none had been taken since Say's time. In 1930 I took one in the Smoky Mts. of North Carolina, and Prof. Pearse sends several specimens taken at Duke Forest.

The mandibles above are mostly covered with an arrangement of imbricated rounded scales (castanulate); the jaws are smooth, and slightly outcurved at tip. On the swollen part of mandible not far from base of the jaws is a sloping tubercle, tipped by a long, fine bristle. Each side of the front margin of the body ends in a sharp point, also tipped by a bristle.

A short distance behind the front is a transverse, nearly parallel ridge, most prominent on the sides, between this and the front margin the surface is sculptured as on the mandibles and also in a median raised region behind the ridge, elsewhere the sculpturing is less perfect, tending to be reticulate or granulate. Each side of the median raised area is a fairly prominent clear spot with a hair, possibly corresponding to stigma and seta; a few smaller hairs and bases on front part of body. The side before middle is somewhat swollen, and here are the two "eye spots," facing laterally. The hind one is very large, the one in front much smaller; just in front of the small one arises a long, back-ward directed bristle; two very short hairs at tip of body.

On the venter the coxæ meet in the middle and beyond are six joints, the first and third are quite short (probably trochanter and patella), beyond are two long and the short terminal joint, probably tibia, protarsus and tarsus. The front tarsus ends in two nearly equal claws. The other legs do not have a short patella, the fourth joint from tip being longer than the one beyond it, and the last joint (tarsus) much longer than the penultimate; all legs have fine short hairs, most abundant on the tarsi. The tarsi of the second, third, and fourth pairs end in three claws, the median claw not as much curved as the laterals.

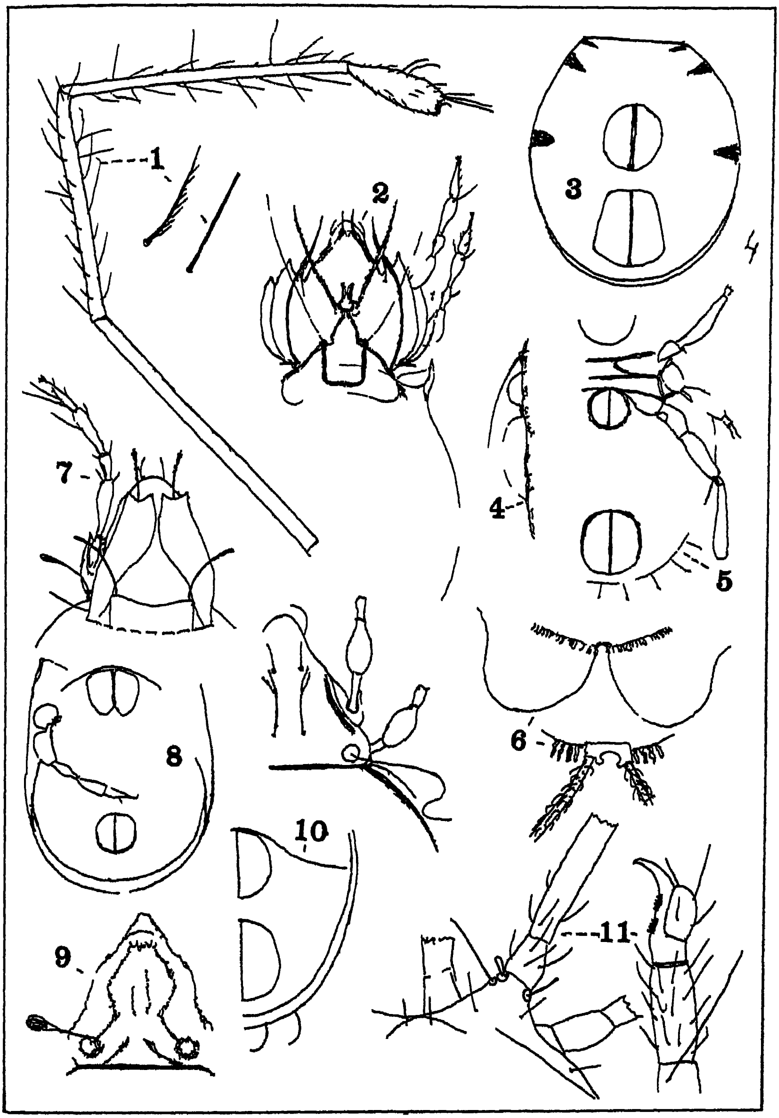
In the female the ventral openings are united in one, which is divided by a transverse line at posterior third, near sides the line curves forward. In the male the two openings are slightly separated, the genital much the larger.

EXPLANATION OF PLATES

PLATE 5

Fig. 1. First leg of *Erythræus carolinus,* and hairs from body.
Fig. 2. *Oribatella carolina,* cephalothorax and base of abdomen from above.
Fig. 3. *Jacotella quadricaudicula,* venter.
Fig. 4. *Labidostomma mamillatus,* "eyes" from above.
Fig. 5. *Xenillus occultis,* venter.
Fig. 6. *Allodamœus ewingi,* tip of abdomen of nymph.
Fig. 7. *Xenillus occultus,* cephalothorax.
Fig. 8. *Oribatella carolina,* venter.
Fig. 9. *Carabodoides retracta,* cephalothorax.
Fig. 10. *Eremobelba gracilior,* cephalothorax, and venter.
Fig. 11. *Erythræus carolinus,* corner of cephalothorax, and palpus.

PSYCHE, 1947 VOL. 54, PLATE 5

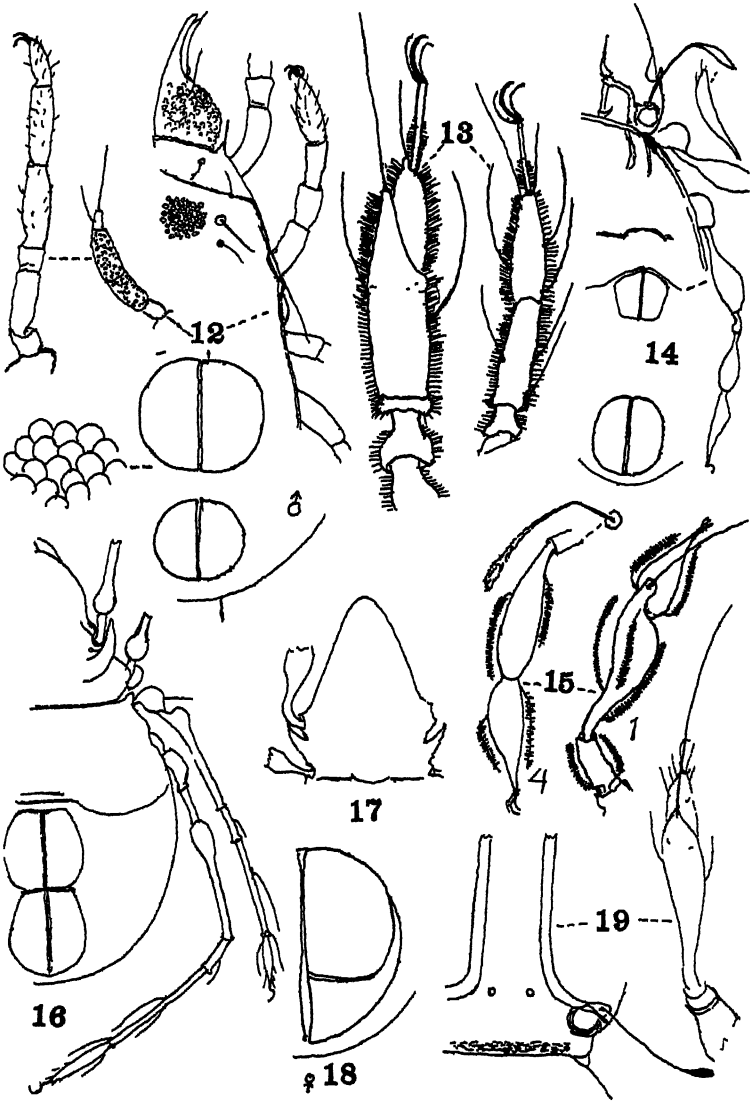


BANKS—ACARINA

PLATE 6

Fig. 12. *Labidostomma mamillatus,* side of cephalothorax; first leg, palpus, ventral apertures of male, and sculpture of mandible.
Fig. 13. *Allodamæus ewingi,* first and second legs.
Fig. 14. *Oppiella apicalis,* side of cephalothorax, and venter.
Fig. 15. *Jacotella quadricaudicula,* seta, and apical part of first and fourth legs.
Fig. 16. *Gymnodamæus pearsei,* under side.
Fig. 17. *Oppiella apicalis,* cephalothorax below.
Fig. 18. *Labididostomma mamillatus,* ventral aperture of female.
Fig. 19. *Autogneta amica,* part of cephalothorax, and front tarsus.

PSYCHE, 1947 VOL. 54, PLATE 6



BANKS—ACARINA

PLATE 7

Fig. 20. *Eremæus politus,* cephalothorax, first leg, and claw.
Fig. 21. *Autogneta amica,* venter.
Fig. 22. *Eremæus politus,* venter, and second leg.
Fig. 23. *Eremobelba gracilior,* cephalothorax from below, and fourth leg.
Fig. 24. *Alloribates singularis,* cephalothorax, wing from side, third and fourth legs, and first tibia and tarsus.
Fig. 25. *Alloribates singularis,* venter, and fourth leg.

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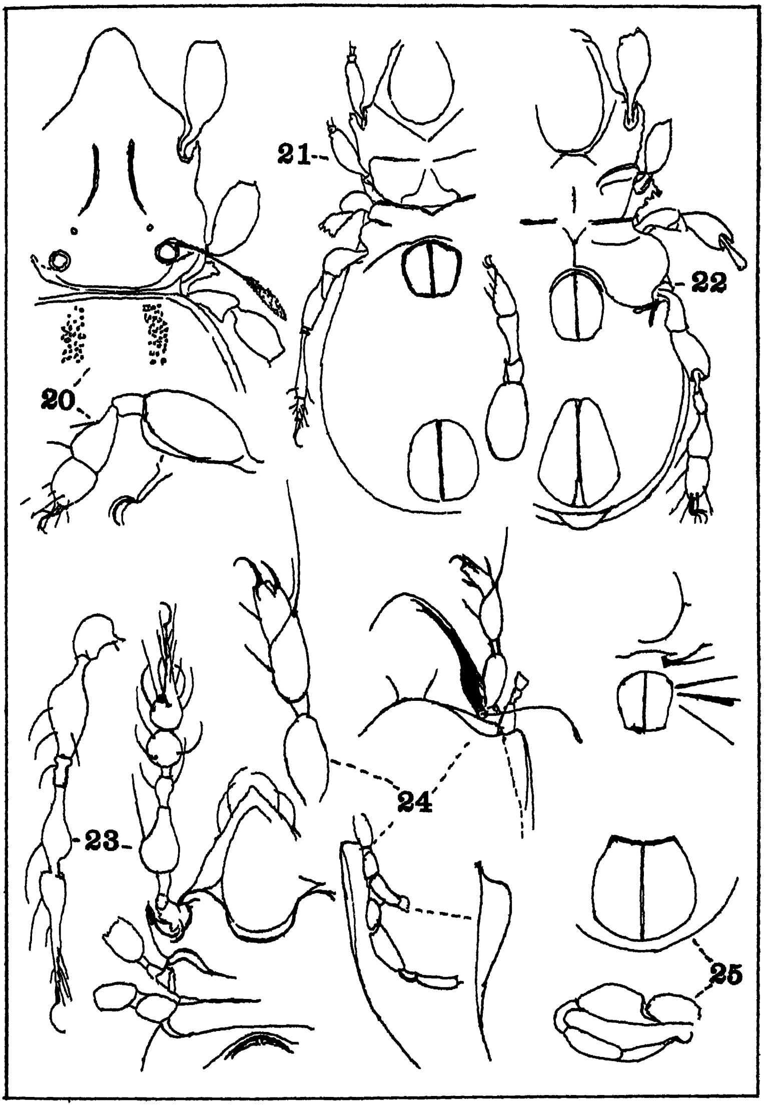
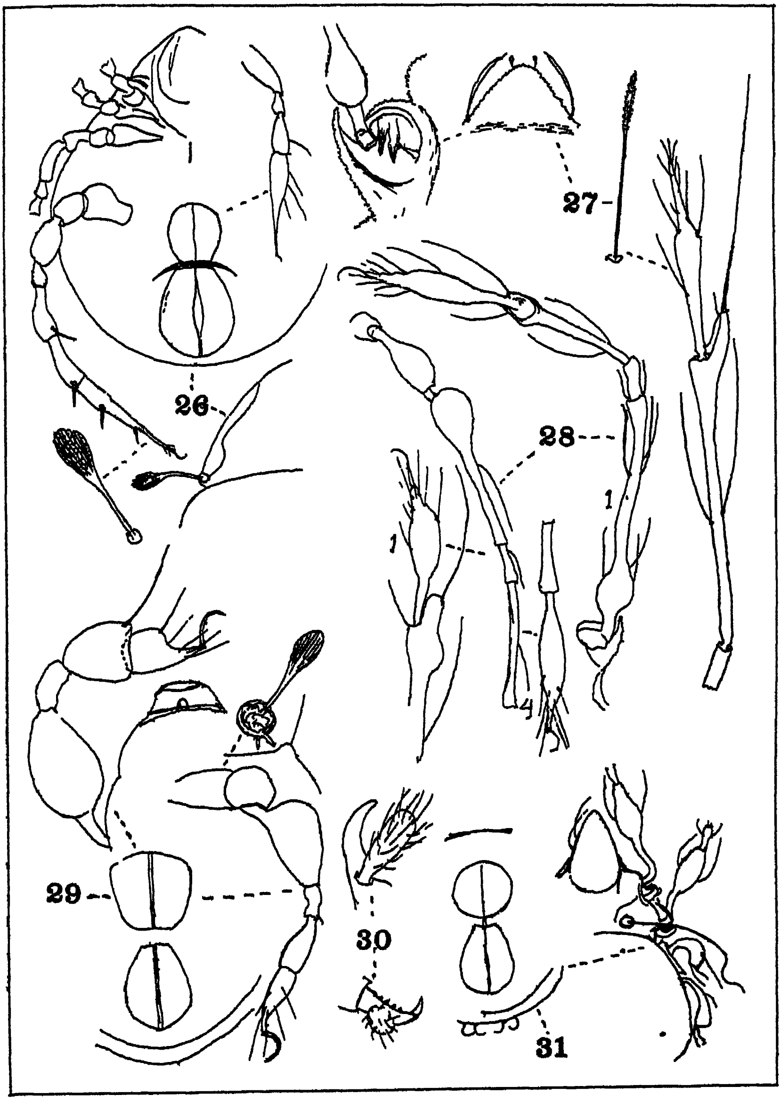


Banks—Acarina

PLATE 8

Fig. 26. *Zetorchestes equestris,* venter, edge of cephalothorax, seta, and first leg.
Fig. 27. *Gymnodamæus pearsei,* first tibia and tarsus, seta, tip of cephalothorax, and attachment of first leg.
Fig. 28. *Gymnodamæus minor,* first leg, showing tibia beneath, tibia and tarsus of first leg, showing tibia from side, fourth leg.
Fig. 29. *Carabodoides retracta,* venter, seta, and first leg and edge of cephalothorax.
Fig. 30. *Erythræus exilipes,* palpus from two views.
Fig. 31. *Oribata diversipes,* cephalothorax, and venter.

PSYCHE, 1947 VOL. 54, PLATE 8

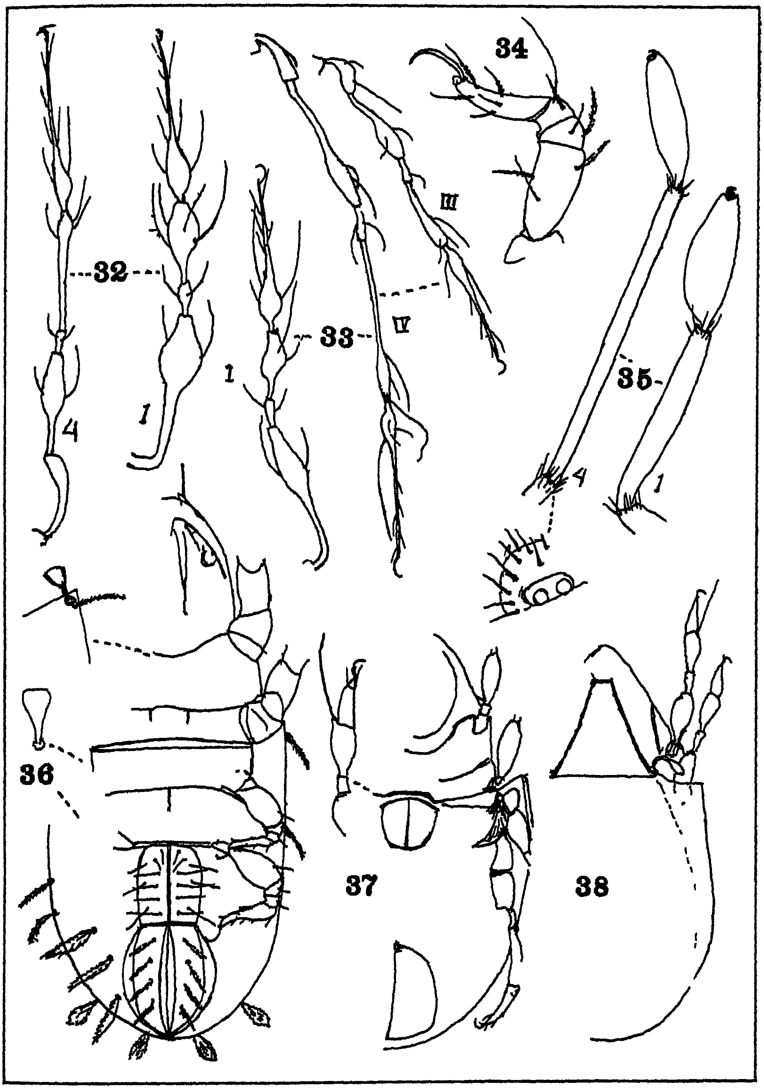


BANKS—ACARINA

PLATE 9

Fig. 32. *Belba inæquipes,* first and fourth legs.
Fig. 33. *Oribata diversipes,* first, third, and fourth legs.
Fig. 34. *Lohmannia brevipes,* fourth leg.
Fig. 35. *Erythræus exilipes,* tibia and tarsus of first and fourth legs, eyes.
Fig. 36. *Lohmannia brevipes,* venter, and seta.
Fig. 37. *Minunthozetes angusta,* venter, tibia and tarsus of first leg.
Fig. 38. *Minunthozetes angusta,* dorsum.

PSYCHE, 1947 VOL. 54, PLATE 9

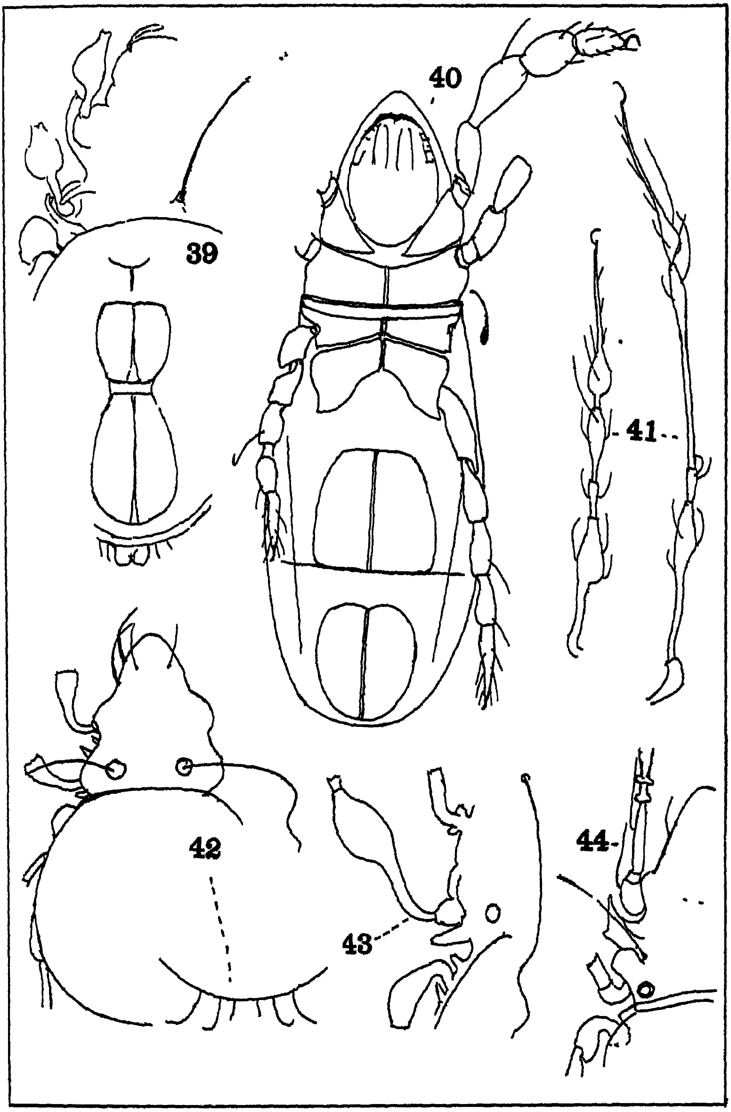


BANKS—ACARINA

PLATE 10

Fig. 39. *Gymnodamæus minor,* side of cephalothorax, seta, and ventral apertures.
Fig. 40. *Epilohmannia elongata,* under side.
Fig. 41. *Oribata carolinensis,* first, and fourth legs.
Fig. 42. *Oribata carolinensis,* above.
Fig. 43. *Belba inæquipes,* side of cephalothorax, seta and tip of abdomen.
Fig. 44. *Allodamæus ewingi,* side of cephalothorax.

PSYCHE, 1947 VOL. 54, PLATE 10



BANKS—ACARINA

TRICHOPRIA TABANIVORA FOUTS IN MASSACHUSETTS (HYMENOPTERA, DIAPRIIDÆ)

By Norman S. Bailey
Biological Laboratories, Cambridge, Massachusetts

In the course of field investigations into the life history of the Saltmarsh Greenhead, *Tabanus nigrovittatus* Macquart, being carried out for the state of Massachusetts, two pupæ of that species were found. They were located in a pile of drift composed chiefly of coarse *Spartina* straw and the remains of other salt marsh plants that had accumulated on a ditch bank near the edge of the marsh. . The pupæ were discovered on August 9, 1946, on the Pine Island Marsh in Newbury (Essex County). One was of the usual coloration, but the other was decidedly blackened and appeared unhealthy. Both were kept in small vials with a bit of the debris. A male horsefly emerged from the sound pupa and on August fourteenth a score of minute parasitic wasps came out of the second.

These were kindly determined for me by Mr. C. F. W. Muesebeck of the U.S.D.A. Bureau of Entomology and Plant Quarantine as *Trichopria tabanivora* Fouts of the Proctotrypid family Diapriidæ.

A subsequent search of the literature failed to reveal any record of the species since those originally reported by Cameron.[1] Segal repeated Cameron's record in his paper on the genus *Chrysops.*[2] Prof. Cameron raised 98 from a pupa of *Chrysops mitis* O.S. taken at Saskatoon and 112 from a pupa of *Tabanus reinwardtii* Weid. collected in Maple Creek, Saskatchewan. Fouts' description of the species was published with this data.[1]

This note indicates another Tabanid host species, a very different habitat, and a notable extension of range for the parasite. Furthermore, as far as the writer has been able to discover, these are the only known records of pupal parasites of Tabanidæ.

Six specimens of the series were sent to Mr. Muesebeck as the Bureau of Entomology collection contained only one paratype; twelve are in the Museum of Comparative Zoology.

---

[1] Cameron, A. E., Bull. Ent. Res., Vol. 17, Pt. 1, 1–42, 1926.

[2] Segal, Bernard, N. Y. Ent. Soc. Jour., Vol. 44, 51–78, 1936.

BOOK NOTICE

FLEAS OF WESTERN NORTH AMERICA. Their Relation to the Public Health; by Clarence Andresen Hubbard; pp. i–ix + 1–533, 5 half-tone plates, and many text figures. 1947. (The Iowa State College Press, Ames, Iowa. $6.00).

This companion volume to Irving Fox' "Fleas of Eastern United States," from the same Press (1940), far outstrips in scope any similar attempt in the field of the Siphonaptera. It is a handsome book, clearly printed and attractively bound.

The work opens with a history of the study of fleas in western North America, a feature to which entomologists are little accustomed. In a brief but competent discussion of fleas and disease it is stated that, since the introduction of bubonic plague in the United States in 1900, there have been 506 human cases, 321 of them fatal. It is to be feared, nevertheless, that the author's "Word of Warning" will fall upon deaf ears. Collecting ectoparasites is not a normal activity of the average entomologist. Hubbard describes in detail the special techniques involved in trapping the hosts, gathering the fleas, and mounting the specimens for study.

The chapter on the external anatomy of the flea is disappointing. For advanced students it could have been omitted altogether; while it is far too sketchy to meet the beginner's needs. Even some terms used in the main body of the book—such as pygidium, mesosternite and mesopleurite—are not explained.

The foregoing general topics cover a bare 40 pages, the bulk of the treatise being a detailed taxonomic study of 236 species and subspecies of Siphonaptera known to the author from North America west of the 100th Meridian. These he classifies in 5 families and 66 genera. Keys are provided for the identification of families and genera, and for the species and subspecies of most genera, with the exception of *Ceratophyllus* and *Megarthroglossus*. However, some of the keys to species are based on males only. Type locality and type host are given for nearly every form; but the present location of the types is omitted in most cases. The descriptions are clear and the many illustrations of details, comparing closely allied forms are most commendable.

Only 12 of the 302 fleas listed from America north of Mexico extend across the continent; and this number dwindles to 5 (one of them doubtfully in the East) after eliminating 7 species introduced from the Old World by man. The eastern flea fauna is, moreover, scanty, only 56 species and subspecies being known from east of the 100th Meridian, as against 236 from the western area. The explanation lies, of course, in the extremely poor mammalian fauna of the eastern area. The author has relied too exclusively on Irving Fox' book (1940) for his information on eastern fleas. H. S. Fuller in 1943 raised the number of species known from Vermont to 15 (not *one*, as stated by Hubbard), and recorded 9 species from West Virginia, from which state Hubbard says there are no published records.

In the careful and elaborate analysis of host relationships, the notes on the characteristics and behavior of the several types of hosts will be particularly useful. The relations between blood-sucking ectoparasites and their hosts are not merely those of taking and giving food. The parasite's structure, life-history and behavior are in most cases closely correlated with those of the host. The author's detailed information on the relative abundance of the several species of fleas often found on the same host may help to determine the normal or breeding, and the accidental or stray hosts of each species, leading eventually to the study of the factors determining the choice of the host.

The author is to be congratulated on his book, which crowns some fifteen years of field and laboratory work carried on with unusual enthusiasm.—J. BEQUAERT

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The June, 1947, PSYCHE (Vol. 54, No. 2) was mailed June 19, 1947.

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PSYCHE

VOL. 54 SEPTEMBER, 1947 No. 3

NOTES ON DILARIDÆ AND BEROTHIDÆ, WITH SPECIAL REFERENCE TO THE IMMATURE STAGES OF THE NEARCTIC GENERA (NEUROPTERA)

BY ASHLEY B. GURNEY
Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture

To students of neuropteroid insects, as well as to entomologists interested in specialized types of holometabolous larvæ, it will be significant that the immature stages of *Nallachius* and *Lomamyia* have been found. *Nallachius* is the only Nearctic genus of Dilaridæ and contains two species in the United States, both of which were originally referred to the genus *Dilar*. *Lomamyia* is the sole Nearctic genus of Berothidæ, represented in this country by 10 species, and, like *Nallachius*, they are all relatively rare insects. With the exception of the eggs and first-stage larvæ of *Spermophorella*, an Australian berothid genus, the young stages of these two families have been entirely unknown. Though some details of the biologies of *Nallachius* and *Lomamyia* are still unknown, the main features may now be presented. Their larvæ prove to be related, though perfectly distinct, predators which attack soft-bodied insects.

The discovery and recognition of the young of these insects may be largely attributed to the collecting zeal and generous cooperation of my colleagues, William H. Anderson and Herbert S. Barber. Dr. Anderson collected the male allotype[1] of *Nallachius americanus* (McL.) in 1939, and has also collected four lots of larvæ, with one lot of which two pupæ were associated. The pupæ died before maturity, but possess the characters of the adult sufficiently well to permit identification. A cast larval skin of one is identical with larvæ which he collected. This material of *americanus* was first correctly identified in 1945 by Henry K. Townes. More than 50 years ago the late H. G. Hubbard collected a single nearly fully grown larva of *Lomamyia* which could not then be identified. A similar, though fully developed, larva taken in 1941 by R. J. Kowal likewise could not be named until the key to this identification puzzle was secured through study of first-stage larvæ hatched by Mr. Barber in 1919 from eggs laid by a captive *Lomamyia.*[2] F. M. Carpenter of Harvard University made some most helpful suggestions, when he learned of the study in progress, and I am also grateful for the photograph of *Nallachius* wings (fig. 1) which he kindly offered to make. Finally, I would express my appreciation to George E. Wallace of the Carnegie Museum for the loan of adult specimens of *Nallachius americanus* and the privilege of retaining two of them for the United States National Museum.

---

[1] Designated by Carpenter (1940) subsequent to the original description, 1881. This specimen was reared, but the cast skins were not recovered.

In this paper I have included a few notes on the distribution and variation of *Nallachius americanus,* though my primary object is to compare the immature stages of *Nallachius* and *Lomamyia* morphologically and to discuss the relationship of the Dilaridæ and Berothidæ to other families in the light of present information.

DILARIDÆ

The genus *Nallachius* Navas

Nallachius Navas, 1909, Mem. Real Acad. Cienc. Artes Barcelona, vol 7, pp. 627, 666. Genotype: *Dilar prestoni* McL., 1880, designated by Navas (1914).

Carpenter's revision (1940) and subsequent additions (1942, 1947) should be consulted for information on the taxonomy and distribution of the Nearctic Dilaridæ and

---

[2] The specific identity of this female is uncertain. It was determined as *L. flavicornis* (Walk.) by A. N. Caudell in 1919, but determinations current at that time are rendered untrustworthy by the description of several species then unrecognized. The specimen was utilized for morphological study and is not now available.

Berothidæ. The only sizable collection of *Nallachius* adults yet reported is that of Steyskal (1944), who collected six females and 21 males of *americanus* flying around a single dead tree in Detroit, Mich., during the months of June and July. It is possible that larvæ occurred in this tree, and also that oviposition was in progress.

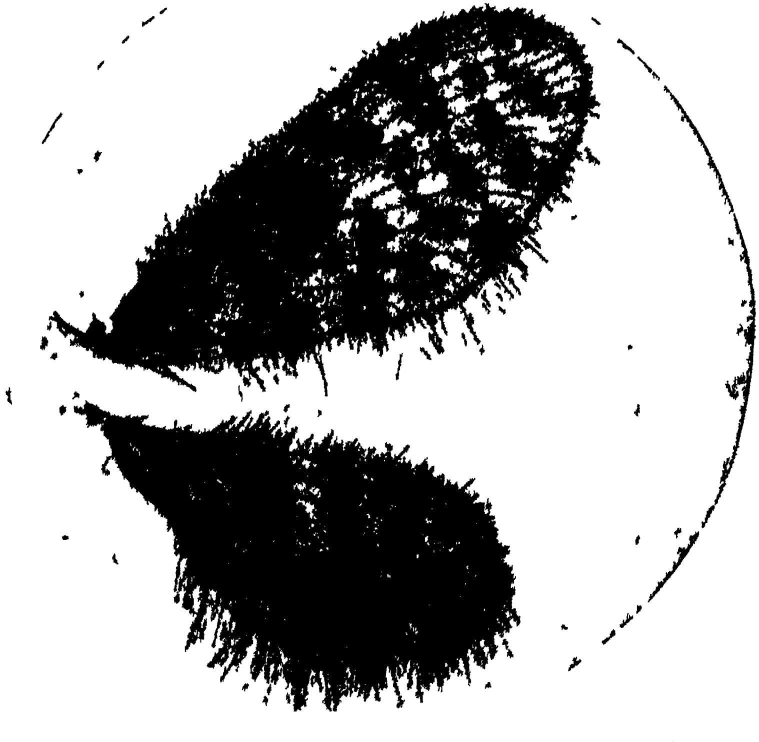

Fig 1. *Nallachius americanus* (McL), female, dorsal view of right wings Length of front wing, 7 5 mm Brookline, Pittsburgh, Pa Photograph by F M Carpenter

Previously unreported adult material of *N. americanus* consists of four males and four females from the Pittsburgh area of Pennsylvania, one male from Odenton, Md., and a male from Bainbridge, Ga. (Detailed data appear in the section headed "Material examined.") The wings (fig. 1) are specific for this insect, but male genitalia should be examined to confirm identifications whenever possible. A photograph of the wings has not previously been published, though Costa Lima (1943, figs. 54, 55) has given excellent photographs of the Brazilian *N. prestoni.* Size variation is indicated by the Pittsburgh series, a front wing of each of the males measuring (length in millimeters) 5.1, 4.8, 4.8, 3.6, respectively, and a front wing of each of the females from the same series measuring 7.5, 6.3, 6.1, 5.6, respectively. Forewings of the Odenton and Bainbridge males measure 4.2 and 4.3 mm. Male antennæ usually include 9 pectinations (plus the apex of the central axis), though a few specimens have 10 pectinations.

Immature stages of *Nallachius americanus*

Eggs.—One female examined (opposite Homewood Cemetery) has a cream-colored egg held at the apex of the ovipositor. It measures about 0.37 × 0.13 mm. and is rounded oblong.

Larva.—General body shape slender, elongate, convex (fig. 6); body setæ sparse, inconspicuous, long, and slender; spiracles well developed on mesothorax and abdominal segments I–VIII, scarcely noticeable without compound microscope. Head with elongate, somewhat blunt jaws of usual Planipennia type (figs. 11, 14); no fracture line of jaws evident; mandible and maxilla subequal in size; apex of maxilla with sensory setæ and spiculelike teeth; front triangularly produced between and anterior to antennal bases; a single dark pigmented, lateral eye spot; a tiny curved spine immediately anterior to eye. Antenna with 2–5 ring segments following scape (total segments 5–8); penultimate segment enlarged, bearing postapical peglike organ (sensory?) and 2 small setæ externolaterally; apical segment with one long principal seta and several minor ones. Prementum apically incised; labial palpus with 2–5 ring segments following basal segment (total segments 5–8). Cervical region (microthorax of Tillyard, 1916) with well-developed dorsolateral lobes.

Thoracic segments without noticeable sclerotized plates; mesothoracic spiracle in fold created by small anterior subsegment. Front legs somewhat more elongate and robust than middle and hind legs. Leg (fig. 21) with femur and tibia moderately compressed; tarsus distinct but capable of little or no movement on tibia; trochanter weakly defined; front claws blunt with anterior claw decidedly shorter than posterior one (fig. 17); claws of middle and hind pairs much smaller than front ones, unequal but not conspicuously so; paired pulvilli (or similar pads) at base of claws; empodium slender, trumpet-shaped, segmented in apical third, a second line of segmentation indistinct. Abdomen uniformly, weakly sclerotized; segments I–VIII with lateral spiracle in anterior third; each lateral margin of segments I–IX (on slide-mounted specimen) with two principal lobes, each lobe with a principal seta.

Coloration: Head gamboge yellow, somewhat darker above; thorax and abdomen uniformly pale, almost colorless; front claws light brown, middle and hind claws paler.

The supposedly mature larvæ of *americanus* range in length from 4.6 mm. to 12 mm., while the number of ring segments of the labial palpus and antenna vary as indicated above, and in several cases there is a difference of one segment in right and left appendages of the same specimen. The larva from College Park is the longest and has the largest number of antennal and palpal segments, but the one from Jackson's Island is the shortest (4.6 mm.) and has one more segment in each appendage than two larvæ from University Park examined in detail (4.8 mm. long, 5 segments in each appendage). The sex of these larvæ is naturally unknown, aside from the cast skin from which a male pupa developed. Adult males average definitely smaller than females. From the evidence now at hand, it is accordingly uncertain whether all or only part of these larvæ are fully developed, whether the number of palpal and antennal segments is variable from instar to instar, as well as in larvæ of the same instar, and whether sex has a bearing on size of larvæ or number of palpal and antennal segments. Only one species of Dilaridæ is now recorded from the eastern United States. Most but not all Neuroptera have 3 larval instars.

Pupa.—The pupa illustrated (fig. 16) is near maturity, as evidenced by well-developed genitalia and wing venation, and dark color of the well-sclerotized portions of thorax and abdomen and on the apical two-thirds of tibia. The wings are practically black, except at the bases, and the *Nallachius*-type venation may be traced. Except as indicated by stippling on figure 16, the pupa is pale. Each antenna is a simple appendage, but the pectinations of the adult are visible within, wound about the central axis in spiral fashion. Body length is 3.26 mm.

The other pupa studied is not so near maturity as the one illustrated, and, though it is clearly a male, the dark areas are scarcely developed and the wing venation cannot be readily traced.

Cocoon.—The cocoon (fig. 3) is a tightly woven white sack without a visible exterior sculpture of any kind. The outer surface is covered loosely, and without regard to pattern, with clay-yellow particles, which appear to be fragments of wood. Others appear to be the excretory pellets of wood-feeding insects and are darker. Frass and various other particles frequently occur in the galleries of wood-boring insects, which explains their presence on the cocoon of *Nallachius.*

Material of *Nallachius americanus* examined[3] (previously unreported):

Adults.—Pittsburgh, Pa., all collected by Hugo Kahl: Fern Hollow, July 15, 1911, near orchard (1♂); Fern Hollow, August 6, 1907, on tree trunk near hilltop (1♀); Southern Avenue Park, July 8, 1911, in coitu (♂, ♀); opposite Homewood Cemetery, on an oak trunk, July 9, 1910 (1♀); Brookline, on tree trunk, July 17, 1910 (1♀).

Ingram, Pa., June 28, 1931, W. D. McIlroy, Jr. (2♂).

Odenton, Md., August 14, 1918, on *Robinia pseudacacia,* W. L. McAtee (1♂).

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[3] All the Pennsylvania specimens except the two from Fern Hollow, July 15, and from Brookline, are deposited in the Carnegie Museum, Pittsburgh, Pa., all other material of both *Nallachius* and *Lomamyia* in the United States National Museum.

Bainbridge, Ga., April 6, 1943, at light, H. R. Dodge (1♂).

Larvæ and pupæ.—Jackson's Isl., Md. (also known as Scott's Isl. or Turkey Isl., located in Potomac River 11 miles above Washington, D. C.), found May 19, 1913, near a larva of *Micromalthus,* while breaking up wood fragments taken from a decaying log, May 5; rearing unsuccessful; dead June 9; many other kinds of larvæ in same log; E. A. Schwarz and H. S. Barber, 1 larva.

Greenbelt, Md., April 13, 1938, beneath bark of moist rotten log, W. H. Anderson, 1 larva.

College Park, Md., October 18, 1942, under bark of dead oak, W. H. Anderson, 1 larva.

University Park, Md., January 28, 1945, in hard dead tulip-tree wood in galleries of living larvae of *Pentarthrinus* and *Phlœophagus* weevils, W. H. Anderson, 4 larvæ. Two pupæ in cocoons recovered from same wood sample, but not in same gallery with the 4 larvae.

Langley, Va., November 1, 1939, with bark from tree, W. H. Anderson, 1 larva.

Biological notes: While the larvæ of *Nallachius* have not been observed feeding, there is no doubt that they attack other insects, as indicated by the piercing-sucking jaws and their presence within the galleries of wood-inhabiting insects. They themselves are not equipped to bore in wood, though the rather heavy claws, particularly those of the front legs, are presumably well adapted to locomotion in galleries often somewhat choked with the frass of their would-be victims. The integument of most of the larval body is pale and weakly sclerotized, apparently an adaptation to a minimum exposure to light and the open air. Most adults evidently emerge during spring and early summer. Apparently there is a single generation per year and a 1-year life cycle. A large percentage of adults recorded were collected on or about tree trunks, and eggs are probably inserted into the cracks of dead wood or the crevices of or beneath dead bark. Judging from the long ovipositor, it is extremely unlikely that the eggs are stalked.

BEROTHIDÆ

The genus *Lomamyia* Banks

Lomamyia Banks, 1904,[4] Proc. Ent. Soc. Wash., vol. 6, p. 209.

Genotype: *Hemerobius flavicornis* Walk., by monotypy.

Two species, *flavicornis* and *banksi* Carp., are recorded from the vicinity of Washington, D. C., and it is possible that still others occur here, so the specific identity of the larvæ described below cannot be determined.

Immature stages of *Lomamyia*

Eggs.—While confined in a glass tube, a female collected at light on Plummer's Isl., Md., June 16, 1919, laid clustered stalked eggs similar to those of many Chrysopidæ. There was one cluster of 12 white eggs, each about 0.7 mm. long, attached to the end of a threadlike stalk 6 mm. long, the terminal end of the stalk being more slender than the base. There were several smaller and less perfect clusters. After 24 hours the eggs had transverse dark bars due to the development of banded embryos. Smith (1923, p. 139) has described a single infertile unstalked egg laid by a captive female of *Lomamyia.* The unstalked condition may have been abnormal.

First-stage larva.—General body shape (fig. 2) much as in *Nallachius,* head more elongate; jaws subequal in length to palpi and antennæ; 3 pairs of equal legs; maxilla dominant, with scalelike dorsal sculpture (fig. 8), the apical tenth specialized and weakly serrate (fig. 7); mandible reduced, slender, lateral; labial palpus and antenna 3-segmented, second and third segments each with numerous annulations. Front broadly produced; two lateral eye spots; cervical region and legs well developed; laterodorsal thoracic sclerites absent or inconspicuous;[5] thorax and abdomen with conspicuous reddish purple transverse bands, as shown by stippling (fig. 2).

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[4] The genus *Lomamyia* was first proposed in a list of species; the formal description appeared late the following year in Banks' revision of the Nearctic Hemerobiidæ.

[5] See Killington (1936, fig. 43, p. 97).

Fully developed larva (possibly more correctly described as a prepupa, though no cocoon is associated).—Abdomen much more enlarged than head, in contrast to first instar (fig. 5); legs reduced; jaws truncate, much shorter than palpi (loss of apices by fracture possible but uncertain); maxilla with conspicuous sculpture (fig. 12). Front more produced than in the first instar, broadly rounded; anterior half of median dorsal surface of head with broadly convex area poorly demarked; posterior half with pattern of pale sutures and 3 lateral setæ. Prementum small, irregular, anterior margin entire; mentum narrowed apically, broadly rounded basally, flanked by elongate sclerites (undifferentiated cardo and stipes?); cervical region with conspicuous, laterally concave apodemes, each with a detached, V-shaped base. Front and middle legs subequal (hind legs lost); tarsus rather freely articulated with tibia (fig. 22); trochanter distinct; tarsal claws equal; no observed pulvilli at base of claws; empodium apparently broadly incised apically, otherwise much as in *Nallachius;* a definite "sole" ventrad of claws (fig. 18). Pronotum with large paired laterodorsal sclerites on anterior two-thirds, a weak transverse suture on posterior third; meso- and metanotum each with small, narrow, semilunar sclerites; anal sucker apparently well developed.

Coloration: Head, cervical apodemes, thoracic sclerites, and coxæ brown; claws and "sole" pale brown; abdomen with poorly demarked dorsal pattern of light purple transverse bands; remainder pale. The unpublished notes of H. G. Hubbard contain the following description, made from life, of the Washington larva:

"General color is purple-brown, darker on thoracic segments and almost black on the head; lighter beneath; variegated with pure white. The legs and mouth organs are translucent white. Beneath, each abdominal segment has a large triangular spot of yellowish white, which looks like the luminous glands of Lampyridæ, but was found not luminous above or below. The dorsal surface is gaily decorated with snow-white markings—viz.: On prothorax, on each side, a narrow white line beginning behind the middle; on meso- and metathorax, on each side, just above the legs a quadrate white spot; on second, third, fourth and fifth abdominal segments, also a narrow transverse band of white extending entirely across the segment near the hind margin, the ends of the bands enlarged, rounded and slightly curved forwards; the same white band on sixth and seventh segments but interrupted or less conspicuous (obsolete); the last two abdominal segments are pale and the terminal one is a suckerlike organ, not used in progression, but assisting the insect to cling to smooth surfaces, as in *Hemerobius*.”

The slide-mounted Washington larva shows that the prothoracic laterodorsal sclerites bear several setæ, each arising from a well-developed pit. The sclerites of meso- and metanotum each bear a single posterior seta arising from a large pit. Other thoracic and abdominal setæ are sparse, inconspicuous, mainly arranged in transverse rows.

Both the Washington and Beltsville larvæ have the jaws proportionally much shorter than those of first-stage larvæ, but there is no definite fracture line, as described in *Osmylus* by Killington (1936, pp. 99, 224) and Withycombe (1923, p. 516), and the maxillæ of the Washington larva are not broken off evenly with the mandibles. Study of more material will be necessary to determine whether there is a normal shortening of the jaws subsequent to the first instar, whether there is a regular fracture prior to pupation, or whether the jaws of the two larvæ here studied were accidentally broken.

Pupa.—Unknown.

Material of *Lomamyia* examined:

Larvæ.—Washington, D. C., July 19, 1895. “Found in the fungus garden (nest) of *Atta occidentalis*[6] in wooded knoll, on Brentwood Road, near Soldiers' Home.” H. G. Hubbard, 1 larva.

Beltsville, Md., October 28, 1941, in fallen log, in pocket containing living and dead termites, R. J. Kowal, 1 larva.

Plummer's Isl., Md. (located in Potomac River 8 miles above Washington, D. C.), hatched from eggs laid by female collected at light June 16, 1919, H. S. Barber, 6 first-stage larvæ and several eggs.

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[6] My friend, M. R. Smith, has informed me that the ant in question was almost surely *Trachymyrmex septentrionalis* (McCook). Specimens are not known to have been preserved.

Biological notes: The first-stage larvæ reared by Mr. Barber hatched from 2-day-old eggs and were kept in a vial. His notes and those of A. N. Caudell describe these larvæ as extremely active, running very rapidly on the smooth glass surface without use of the anal sucker. A crushed fly offered as food was not touched, and they attempted unsuccessfully to pierce larvæ of ants. Living larvæ and pupæ of Scolytidæ and immature termites proved very attractive. A larva would rush up to a victim, stop, then lunge forward and pierce the prey with the jaw of one side. After the jaw was withdrawn, the head would be turned to direct the jaw of the other side toward the prey, whereupon another lunge would be made. With a lens Mr. Caudell observed the jaws inserted into scolytid larvæ. It was seen that some of the *Lomamyia* larvæ increased in size, and the scolytid larvæ were dead the following day. The *Lomamyia* larvæ unfortunately died within a few days, perhaps due to a low atmospheric humidity.

There is no indication that the Beltsville larva (fig. 5) was removed from a cocoon; its robust abdomen and very small legs may point to a recent engorgement or a sedentary life, rather than preparation for pupation. Killington (1936, p. 128) should be consulted for a discussion of neuropterous prepupæ. The Washington larva (4.9 mm. long) is apparently in an earlier stage than the Beltsville specimen (9.36 mm.), and an enlarged abdomen is not evident, though its condition is somewhat unsatisfactory. It is suggestive of nest predatism[7] that one larva was taken among ants, the other among termites. I am inclined to believe that the later larval instars of *Lomamyia* are less active than those of *Nallachius*. Snyder (1920, p. 120) reported a strange neuropterous larva which he found in a termite colony at Falls Church, Va., in 1918. His notes lead one to suspect that the larva may have been *Lomamyia,* but the specimen is not now available.

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[7] Wheeler, *Ants*, 1926, p. 382, has discussed enemies living in ant nests, calling them synechthrans. True commensals are of a different nature, living at the expense of but without harm to the host.

Although the larval feeding mechanism of *Lomamyia* is specialized to function almost identically like that of *Nallachius,* the smaller legs of the mature *Lamamyia* larva, and the fact that the front leg and claws equal the middle ones, suggest somewhat different habits. Dr. Anderson consistently sought wood-inhabiting beetle larvæ in his collecting, and five times he secured *Nallachius* larvæ or pupæ, never *Lomamyia.* This fact suggests that *Lomamyia* larvæ occupy a different habitat.

The eggs of the Australian *Spermophorella* are borne on separate stalks, according to Tillyard (1916), and the first instars are much like those of *Lomamyia.* He reported that the larvæ walked with the combined use of legs and anal sucker, moving with a looping action similar to that of Geometridæ.

Principal larval characters distinguishing *Lomamyia* and *Nallachius*

Lomamyia	*Nallachius*
1. Penultimate antennal segment without subapical peg.	1. Subapical peg present.
2. Antennæ and palpi 3-segmented, no supernumerary segments.	2. More than 3-segmented, supernumerary segments present.
3. Maxilla much larger than mandible, dominant both ventrally and dorsally.	3. Mandible and maxilla subequal; mandible conspicuous dorsally, maxilla ventrally.
4. Antennæ borne at lateral extremities of head.	4. Antennal bases much less remote.
5. Anterior margin of front broadly rounded.	5. Anterior margin acute.
6. A single simple eye at each side of head.	6. Two simple eyes at each side.
7. Several ventral sclerites in region of mentum.	7. Ventral sclerites of head reduced in number.
8. Prementum apically entire.	8. Prementum apically divided.
9. Laterodorsal thoracic sclerites well developed.	9. Absent or indistinct.
10. Legs much reduced in proportion to abdomen (mature larva).	10. Legs only moderately reduced in proportion to abdomen.
11. Front legs equal to middle (and hind?) legs.	11. Front legs larger than middle and hind legs.
12. Claws equal.	12. Claws unequal, especially those of front legs.
13. Tarsal claws with a ventral "sole."	13. No "sole" present.
14. Tarso-tibial joint mobile; trochanter distinct.	14. Tarso-tibial joint apparently not mobile; trochanter poorly developed.

The foregoing generic characters are subject to modification as larvæ of other species become known. In sorting material, the subapical peg of the penultimate antennal segment of *Nallachius* and the sculptured dorsal surface of the maxilla of *Lomamyia* have been found particularly useful characters. The dominance of the maxilla in *Lomamyia* is one of the most fundamental differences between the two genera. Withycombe (1925, p. 328) has attached considerable significance to the relative dominance of mandible and maxilla in neuropterous families. Tillyard (1916) stated that the mandible of *Spermophorella* is dominant, but his figures indicate that the first instar larva (figs. 4, 10) is very much like that of *Lomamyia* (figs. 2, 8), and it is possible that he misinterpreted the mouthparts. If that be true, the close similarity of *Spermophorella* and *Lomamyia* larvæ strongly suggests the stability of larval family characters in the Berothidæ, even when represented by genera occurring in distant parts of the world.

FAMILY RELATIONSHIPS

The larvæ of neither the Berothidæ nor the Dilaridæ, as represented by the genera studied, may readily be confused with those of any other family. The terrestrial neuropterous larvæ most familiar to entomologists are Chrysopidæ and Hemerobiidæ. The latter are superficialy suggestive of Berothidæ and Dilaridæ, but in each case, as in the hemerobiid genus *Wesmælius* (fig. 9), the jaws are strongly incurved, not extending straight forward. In fact, the berothids and dilarids clearly belong to what Withycombe (1925) has termed the straight-jawed families of Neuroptera, in contrast to the many families whose larvæ consistently have strongly incurved jaws. First-instar Hemerobiidæ have a trumpet-shaped empodium, but this becomes a broad pad in later instars (fig. 20). The Chrysopidæ is one of the very few families to retain a trumpet-shaped empodium in all larval instars (fig. 19). The well-illustrated key by Townsend (1935) will enable students to recognize the families of most Nearctic neuropterous larvæ.

Withycombe placed the Dilaridæ and Berothidæ, together with the Mantispidæ, Osmylidæ, Sisyridæ, and Myiodactylidæ, in a superfamily called the Osmyloidea. With the exception of the Myiodactylidæ, I believe that this grouping is entirely correct. Larvæ of the latter have been illustrated and described by Tillyard (1926, fig. U17), and, on the basis of larvæ, it seems clear that the family is related to the Ascalaphidæ and associated families. So far as I am aware, there was no description of myiodactylid larvæ prior to 1926, though Tillyard (1917, p. 543) mentioned the larva of *Myiodactylus* and indicated it would later be described. It is probable, therefore, that no information concerning these larvæ was available to Withycombe, and that the resemblance between Osmylidæ and Myiodactylidæ with respect to wing venation led him to associate closely the two families.

Klingstedt (1937) has suggested that the Dilaridæ may be closely related to the Raphidiodea, basing this view on chromosome structure. Tjeder (1937), who has studied the external and internal anatomy of adult Dilaridæ and Raphidiodea, points out both similarities and dissimilarities, and concludes that sufficiently close relationship is shown to justify transferring the Dilaridæ from the Neuroptera (strict sense, Planipennia of authors) to the Raphidiodea. Larval characters of the dilarids, previously unknown, impress me as more trustworthy indicators of relationship than the adult characters thus far studied, and consequently I believe the primary affinities of the Dilaridæ are with the Osmyloidea. The Berothidæ are close relatives.

The presence of an ovipositor in both raphidiids and dilarids has led Tjeder and others to suspect close relationship. A comparison of the adult female ovipositor of *Nallachius* (fig. 15) with those of mantispids of the genera *Symphrasis* and *Plega,* and with those of the raphidiid genera *Agulla* and *Inocellia* shows that there is an abrupt bend or elbow at the base of the ovipositor in the first two families which is absent from the Raphidiodea. In several other ways the Mantispidæ suggest affinities with *Nallachius* and *Lomamyia* that appear stronger than any shown by the raphidiids.[8] Trichosors or marginal dots and dashes of the wings, discussed by Killington (1936, p. 34) and Comstock (1918, p. 167), occur in Dilaridæ, Berothidæ, and some Mantispidæ, as well as certain other families, but not in the Raphidiidæ that I have examinel. The swollen body and reduced legs of mature *Lomamyia* larvæ suggest an approach to the parasitic habit, with even more swollen body, of Mantispidæ. The claws and empodium, as well as certain other structures discussed by Withycombe (1925), of first-stage larvæ of Mantispidæ are very similar to those of *Lomamyia.* I have examined larvæ of an unidentified mantispid found by J. C. Bridwell in 1938 in alcohol in which spiders had been collected. In addition to the Nymphidæ and Myiodactylidæ, the Berothidæ, Mantispidæ, and Chrysopidæ are known to lay stalked eggs. While raptorial front legs give the Mantispidæ a quite different superficial appearance from either Dilaridæ or Berothidæ, they are regarded by Withycombe (1925, p. 329) as a specialization rather than as evidence of fundamental lack of relationship.

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[8] Students are referred to two papers on the adult morphology of Raphidiidæ and Mantispidæ, by Ferris and Pennebaker (1939) and Ferris (1940).

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ABBREVIATIONS

cr = cervical region
cx = coxa
ds = dorsolateral thoracic sclerites of pronotum
em = empodium
fe = femur
m = mentum
md = mandible
mx = maxilla
ob = base of ovipositor
pe = sensory (?) peg of antenna
pm = prementum
so = "sole" of tarsal claws
S7 = seventh sternum
ta = tarsus
ti = tibia
tr = trochanter

(Figure 3 drawn by Arthur D. Cushman, other drawings by the author.)

PLATE 11

Fig. 2. *Lomamyia* sp., first-instar larva, dorsal view, right middle leg missing. Length, 2.04 mm.

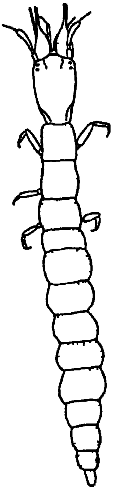
Fig. 3. *Nallachius americanus*, cocoon. Length, 3.26 mm.

Fig. 4. *Spermophorella disseminata* Till., first-instar larva, dorsal view. Length, about 2.5 mm. (Adapted from Tillyard, Proc. Linn. Soc. N. S. Wales, vol. 41, pl. 18, fig. 32, 1916.)

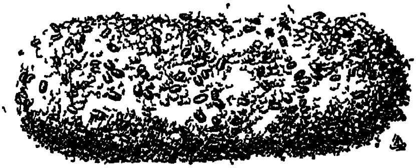
Fig. 5. *Lomamyia* sp., mature larva, dorsal view. Beltsville, Md. Length, 9.36 mm.

Fig. 6. *Nallachius americanus*, mature larva, dorsal view. College Park, Md. Length, 12 mm.

PSYCHE, 1947 VOL. 54, PLATE 11



2.
Lomamyia



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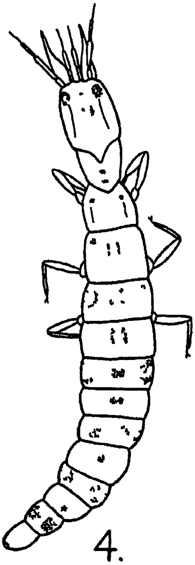

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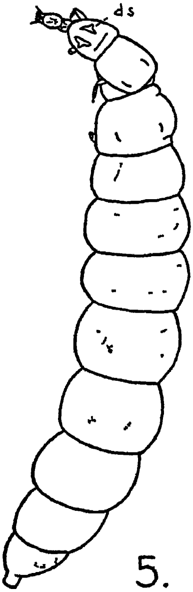
Spermophorella



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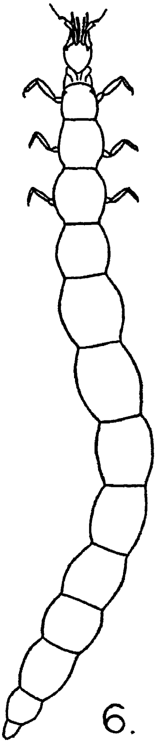
Lomamyia



6.
Nallachius

GURNEY—DILARIDÆ AND BEROTHIDÆ

PLATE 12

Fig. 7. *Lomamyia* sp., first-instar larva, apical fourth of left maxilla, dorsal view.

Fig. 8. Same specimen as fig. 7, dorsal view of head.

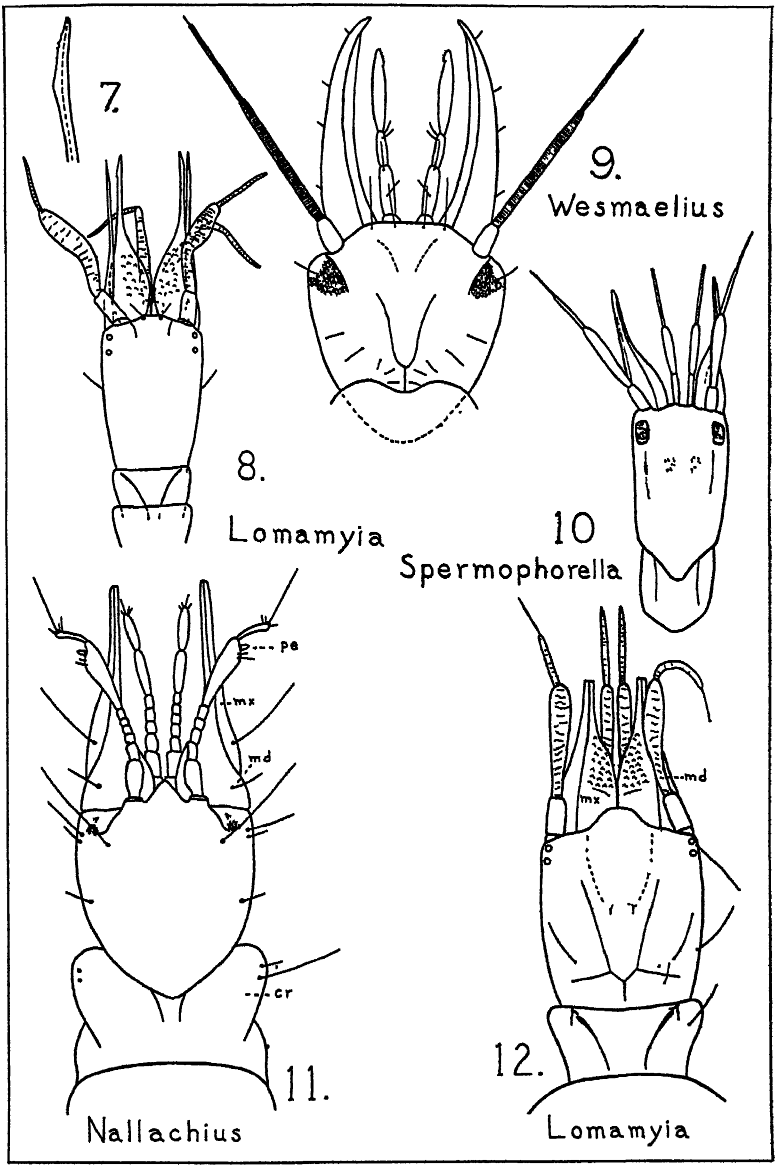
Fig. 9. *Wesmaelius quadrifasciatus* (Reut.), mature larva, dorsal view of head. (Adapted from Killington, A Monograph of the British Neuroptera, vol. 1, fig. 44, A, 1936.)

Fig. 10. *Spermophorella disseminata*, first-instar larva, dorsal view of head and neck. (Adapted from Tillyard, l. c., fig. 33.)

Fig. 11. *Nallachius americanus*, mature larva, dorsal view of head and neck. Same specimen as in fig. 6.

Fig. 12. *Lomamyia* sp., mature larva, dorsal view of head and neck. Same specimen as fig. 5.

PSYCHE, 1947 VOL. 54, PLATE 12



GURNEY—DILARIDÆ AND BEROTHIDÆ

PLATE 13

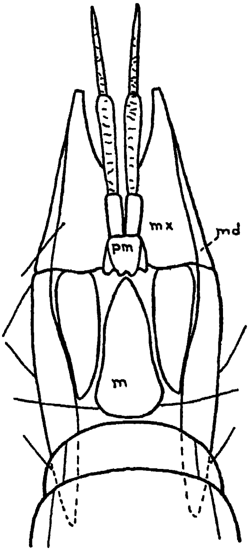
Fig. 13. Same specimen as fig. 12, ventral view of head and neck, antennæ omitted.

Fig. 14. *Nallachius americanus*, mature larva, ventral view of head and neck, antennæ omitted. Same specimen as fig. 6.

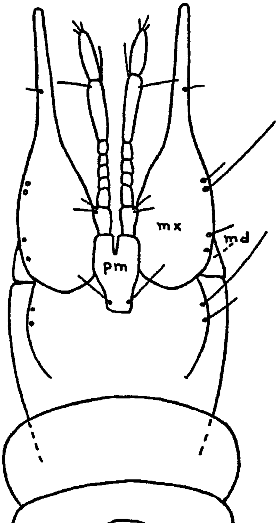
Fig. 15. Same, adult female, right lateral view of apex of abdomen, only base of ovipositor shown. Brookline, Pittsburgh, Pa.

Fig. 16. Same, pupa, left lateral view. Length, 3.26 mm.

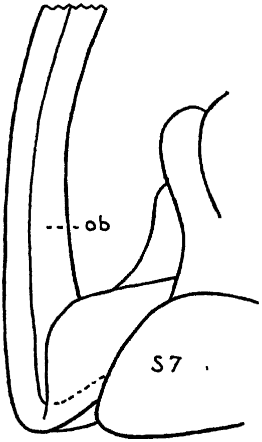
PSYCHE, 1947 VOL. 54, PLATE 13



13. Lomamyia



14
Nallachius



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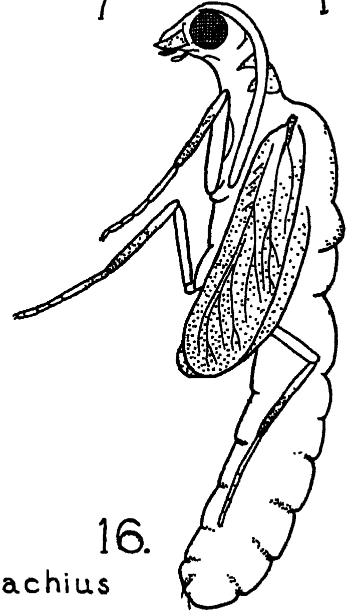


16.

Nallachius

GURNEY—DILARIDÆ AND BEROTHIDÆ

PLATE 14

Fig. 17. Same, apex of right front leg, ventral view. University Park, Md.

Fig. 18. *Lomamyia* sp., apex of left middle leg, anteriolateral view. Same specimen as fig. 5.

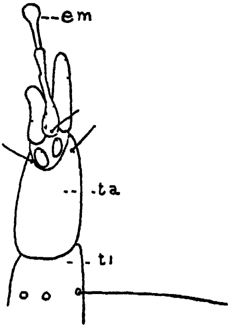
Fig. 19. *Chrysopa* sp., apex of right middle leg, ventrolateral view. Chipley, Fla.

Fig. 20. Unidentified hemerobiid, apex of right middle leg, ventrolateral view. Mexico.

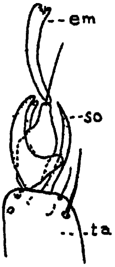
Fig. 21. *Nallachius americanus*, mature or nearly mature larva, right front leg, anterior surface, femur turned into ventrolateral view, only coxal attachments shown. Greenbelt, Md.

Fig. 22. *Lomamyia* sp., mature larva, right front leg, anteriolateral view. Same specimen as fig. 5.

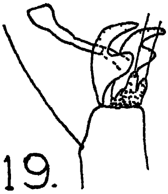
PSYCHE, 1947 VOL. 54, PLATE 14



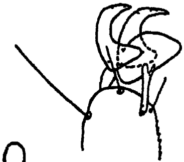
17. Nallachius



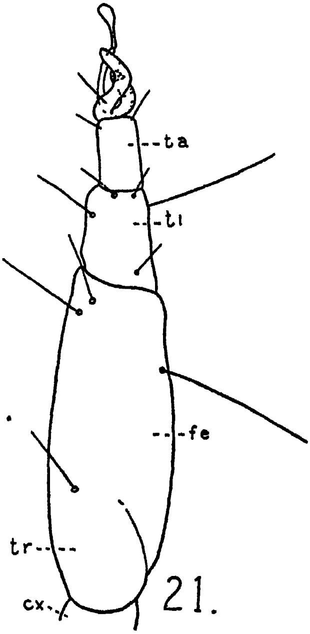
18. Lomamyia



19. Chrysopa

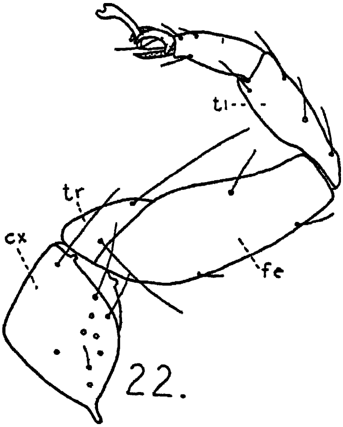


20. Hemerobiid



21.

Nallachius



22.

Lomamyia

GURNEY—DILARIDÆ AND BEROTHIDÆ

NEW SPECIES AND RECORDS OF NORTH AMERICAN HYDROPTILIDÆ (TRICHOPTERA)

By D. G. Denning
University of Wyoming, Laramie, Wyoming

At present approximately 115 species of Hydroptilidæ have been recorded from North America north of Mexico. Because of the difficulty in collecting this group of Trichoptera, due primarily to their small size and seclusive habits, the distribution of all the species is inadequately known. Probably a large number of new species remain to be discovered. The bionomics of most of the species is unknown and many of the species are as yet known only from the male.

A recent study of the Hydroptilidæ in the University of Minnesota collection has resulted in the establishment of a number of very interesting new distributional records, as well as the recognition of several new species. Holotypes are deposited in the collection of the University of Minnesota.

I wish to express my appreciation to Dr. C. E. Mickel for making this collection available for study, and to Dr. Mickel, Dr. Granovsky, Mr. Kretzschmar, Mr. Wirth and others for collecting this material.

Leucotrichia pictipes (Banks)

This fairly common species has been recorded from swiftly flowing streams in most of the northern states from New York to Oregon. Minnesota: Pine Co., Snake River, May 28, 1935 (H. E. Milliron), 5 males. Anoka Co., July, 1939 (D. G. Denning), 1 male. Carlton Co., St. Louis River, Aug. 11, 1940 (D. G. Denning), 40 males, 5 females. Cook Co., Temperance River, May 30, 1941 (H. P. Nicholson), 1 male. Idaho: St. Anthony, June 28, 1938 (H. S. Telford), 12 males, 8 females.

Agraylea multipunctata Curtis

This Holartic species is one of the most common Hydroptilidæ in Minnesota. Available records indicate it is present from early spring to September. The first definite record from North Dakota is recorded herein. MINNESOTA: 97 males, 161 females from all portions of the State, April to Sept. NORTH DAKOTA: Valley City, July 15, 1939 (D. G. Denning), 2 males, 1 female. Wahpeton, July 16, 1937 (D. G. Denning), 2 males, 14 females. BRITISH COLUMBIA: Cowichan Lake, August, 1940 (C. P. Idyll), 3 males, 1 female.

Ithytrichia clavata Morton

This is the first record of the species from Minnesota, although it is known to have a wide range. MINNESOTA: Crookston, June 16, 1941 (D. G. Denning), 1 male, Hallock, light trap, July 7, 1937 (D. G. Denning), 3 males.

Ochrotrichia stylata (Ross)

Previously known from the western part of Wyoming; these are the first records from the eastern portion of the state. WYOMING: Guernsey, N. Platte River, Sept. 6, 1946 (D. G. Denning), 1 male. Near Wheatland, Blue Grass Creek, Aug. 22, 1946 (D. G. Denning), 5 males, 7 females.

Oxyethira serrata Ross

This species has previously been recorded from Illinois, New York and Wisconsin by Ross. The following records extend its known distributions considerably. MINNESOTA: St. Paul, light trap, July 14, 1935 (A. A. Granovsky), 1 male. St. Paul, light trap, Aug., 1934 (A A. Granovsky), 5 males, 4 females. Cass Co., at light, June 17, 1937 (R. H. Nagel), 3 males, 4 females. Cass Lake, light trap, August 1–15, 1934 (A. A. Granovsky), 1 male, 3 females. BRITISH COLUMBIA: Cowichan Lake, August, 1940 (C. P. Idyll), 1 male.

Oxyethira verna Ross

LOUISIANA: Baton Rouge, April, 1947 (W. W. Wirth), 12 males.

Oxyethira obtatus n. sp.

This species can be distinguished from other members of the genus by the apical semi-membranous processes of the ædeagus, the terminally forked condition of the internal sclerotized tube of the ædeagus and several other details of the male genitalia.

Male.—Length 3.2 *mm.* Genitalia as in figs. 1, 1A, and 1B. Mesal projection of seventh sternite small, acute. Lateral lobes of eighth segment produced into a triangular process, heavily setose, deeply incised dorsally; dorsad and mesad to this lobe appears a long attenuated process, directed gradually ventrad, bearing no setæ. Most of ninth segment withdrawn into eighth, caudolateral corner irregular, apparent claspers projected caudad (and slightly dorsad in paratype) beyond remainder of genitalia, slender, subacute, bearing a few minute setæ distally. Viewed from ventral aspect, fig. 1B, claspers slender, diverging mesad, separated by a concave serrate ventral plate. Tenth tergite heavily sclerotized, all but a small portion hidden in ninth segment; when seen from lateral aspect it appears as a somewhat inverted U-shaped structure, caudad branch digitate; viewed ventrally, fig. 1B, apices truncate, almost touching on meson, base arcuate. Ædeagus with base wide, spiral filament encircles tube once, long and slender, extending along side of tube nearly to apex; apical portion divided into two prominent semi-membranous processes, the shorter one bearing a large and two smaller spines, the longer one bearing a single large spine; near their base the internal sclerotized tube terminates as a fork in a small semi-membranous process.

Holotype, male.—St. Paul, Minnesota, August 1, 1934, light trap (A. A. Granovsky).

Paratype, male.—Anoka Co., Minnesota, July, 1939 (D. G. Denning) (specimen damaged).

Orthotrichia americana Banks

Records of Ross and the writer indicate that this species is widely distributed at least through the eastern half of United States. MINNESOTA: St. Paul, light trap, August 1, 1934, 4 male, 3 female; July 14, 1935, 2 male; June 20, 1935, 1 male (A. A. Granovsky).

Orthotrichia cristata Morton

The following records extend the known distribution of the species to Louisiana in the South and Minnesota in the North. MINNESOTA: St. Paul, light trap, July 14, 1935, 3 male (A. A. Granovsky). LOUISIANA: Baton Rouge, April, 1947, 57 male (W. W. Wirth).

Hydroptila armata Ross

The collecting of this species in the treeless plains of northwestern Minnesota is a very interesting extension in its known range. MINNESOTA: Washington Co., May 10, 1941, 5 male, 7 female (G. Kretzschmar). Crookston, Sept. 4, 1936, 1 male, 1 female (D. G. Denning).

Hydroptila spatulata Morton

This is the first definite record of the species from Minnesota. MINNESOTA: St. Paul, Aug. 1, 1934, 1 male, 2 female, light trap (A. A. Granovsky).

Hydroptila hamata Morton

Ross has recorded this species from southern Mexico, Ontario and widely scattered areas in the United States. The following constitutes the first records from Minnesota. MINNESOTA: Taylors Falls, August, 1937, 1 male (Carol J. Palmer). Washington Co., May 10, 1941, 1 male (G. Kretzschmar).

Hydroptila amœna Ross

Known previously from Illinois and Oklahoma; the Minnesota record indicates a wide range for this species. MINNESOTA: St. Paul, light trap, August, 1934, 2 male (A. A. Granovsky).

Hydroptila waubesiana Betten

The species is now known to occur from the Hudson Bay to the Mississippi delta. The following new distributional records make this species one of our most widely distributed Hydroptila. MINNESOTA: Rum River, reared, March 11, 1934, 1 male, 1 female (D. G. Denning). Cass Lake, light trap, August 1–15, 1934, 2 male (A. A.

Granovsky). Crookston, light trap, July 3, 1937, 1 male (D. G. Denning). Anoka Co., Coon Creek, June 4, 1937, 1 male, 1 female (D. G. Denning). NORTH DAKOTA: Wahpeton, July 11, 1934, 1 male, 1 female (D. G. Denning). MANITOBA: Churchill, light trap, August 6, 1937, 1 male (D. G. Denning).

Hydroptila grandiosa Ross

Although widely distributed in Central United States this is the first record from Minnesota. MINNESOTA: Anoka Co., Coon Creek, June 7, 1937, 1 male, 1 female (D. G. Denning).

Hydroptila albicornis Hagen

The records of Ross show the species to be widely distributed; the Minnesota record extends the known range in a northwestwardly direction. MINNESOTA: Cass Lake, light trap, August 1–15, 1934, 3 male (A. A. Granovsky).

Hydroptila consimilis Morton

This is a common species now known to extend from Texas to the Hudson Bay. MINNESOTA: St. Paul, light trap, August 1, 1934, 1 male, 3 female (A. A. Granovsky). Crookston, at light, July 4, 1937, 2 male, 1 female (D. G. Denning). MANITOBA: Churchill, August 2, 43 male, 34 female (D. G. Denning). Churchill, light trap, August 6, 1937, 1 male (D. G. Denning). Churchill River, 20 miles S. of Churchill, August 5, 1937 (D. G. Denning), 5 male, 15 female.

Hydroptila perdita Morton

Ross has recorded this species from Arkansas, Illinois, Michigan, New York, Ontaria and Pennsylvania. MINNESOTA: Carlton Co., St. Louis River, Aug. 11, 1940, 1 male (D. G. Denning). St. Paul, light trap, July 14, 1935, 1 male (A. A. Granovsky).

Hydroptila ajax Ross

The range of *ajax* is poorly known; the following records extend its known range considerably to the North and west. MINNESOTA: Washington Co., May 10, 1941, 1 male (G. Kretzschmar). WYOMING: Guernsey, N. Platte River, Sept. 6, 1946, 1 male (D. G. Denning).

Hydroptila arctia Ross

This species has not been recorded since its original description in 1938 from Idaho. BRITISH COLUMBIA: Cowichan Lake, August, 1940, 2 male, 1 female (C. P. Idyll).

Hydroptila acoma n. sp.

This species can readily be distinguished from other members of the genus by the large spur arising from the apical portion of the ædeagus.

Male.—Genitalia as in figs. 2, 2A and 2B. Lateral lobe of ninth segment acute, slightly upturned, extended caudad about one-half length of claspers. Tenth tergite semi-membranous, mesal incision deep, lateral portions with apices acute and diverging; seen from lateral aspect, fig. 2, distal portion directed dorsad. Claspers slender throughout, divergent, apex truncate, beset with short scattered setæ, between claspers appear two prominent caudad directed tubercles. Ædeagus with basal portion flared, narrowed just before spiral process which encircles ædeagus one and one-half time, its apex lying along side of tube and extending about midway to apex; seen from lateral aspect, fig. 2B, a large acute spur arises at right angles from apical portion.

Holotype, male.—Morgan Hill, California, at light, August 8, 1941 (Roland Johnson) (specimen with head missing).

Hydroptila valhalla n. sp.

This species belongs to the *perdita* Morton group of Hydroptila; it can be readily separated from other species of that group by the curious ædagus and the dorsad directed mesal portion of the tenth tergite.

Male.—Length 3 mm. Genitalia as in figs. 3, 3A, 3B, 3C. Mesal projection of seventh sternite short, apex acute. About half of the eighth segment telescoped into seventh segment. Claspers slender throughout, fig. 3C, divergent, apex acute, darkened and directed laterad, base hidden in ninth segment, which in turn is withdrawn into eighth and seventh segments. Tenth tergite entire, semi-membranous, extending caudad beyond any other portion of genitalia; lateral margins somewhat more heavily sclerotized than remainder; mesal lobe sub-triangular when viewed from dorsal aspect, fig. 3. Ædeagus long and slender, basal portion nearly straight, narrowed toward center then suddenly widened, apparently forms a distinct division from apical portion which is bulbular at base then constricted to an acute apex, entire apical portion turned laterad when viewed dorsally, turned ventrad when viewed from lateral aspect.

Holotype male.—Taylors Falls, Minn., August 1937 (C. J. Palmer).

Mayatrichia ayama Mosely

The available distributional records of Ross indicate this species is widespread; the Minnesota record is an extension in the known northern limits of its range. MINNESOTA: Washington Co., May 10, 1941, 1 male (G. Kretzschmar).

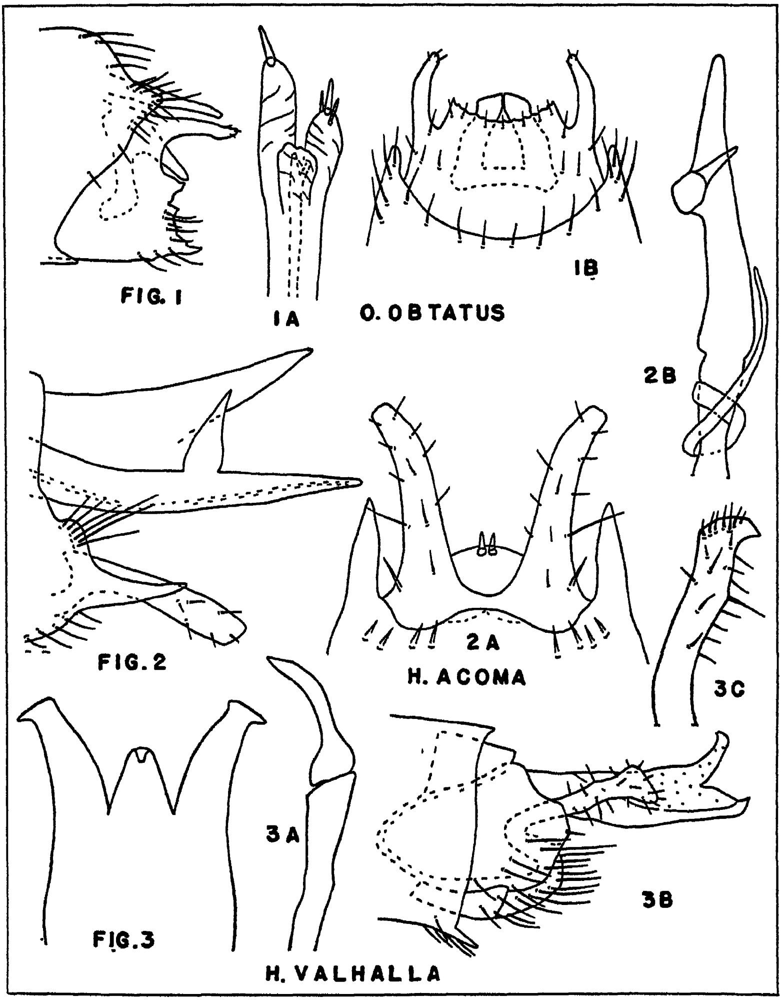
EXPLANATION OF PLATE 15

Fig. 1. *Oxyethira obtatus*, male genitalia, lateral aspect; 1A, apex of ædeagus; 1B, ventral aspect of male genitalia.

Fig. 2. *Hydroptila acoma*, male genitalia, lateral aspect; 2A, ventral aspect of male genitalia; 2B, ædeagus.

Fig. 3. *Hydroptila valhalla*, male genitalia, dorsal aspect; 3A, ædeagus; 3B, lateral aspect of male genitalia; 3C, clasper.

Psyche, 1947 Vol. 54, Plate 15



Denning—Trichoptera

HOSTS OF CERTAIN NEW YORK TICKS

BY GEORGE ANASTOS

Biological Laboratories, Harvard University

The records of ticks contained in this paper are based upon material collected by Mr. R. V. Nardy and Mr. William M. Machado under the general supervision of Dr. Donald L. Collins of the New York State Science Service.

The collection was made at the eastern end of Long Island, New York, from May 10, 1946, to September 9, 1946, at three stations: Montauk Point, Hither Hills State Park, and Hook Pond (East Hampton). It comprised 992 larvæ, nymphs and adults, the following species being represented: *Dermacentor variabilis* (Say), *Hæmaphysalis leporis-palustris* (Packard), *Ixodes cookei* Packard, *Ixodes dentatus* Neumann, *Ixodes muris* Bishopp and Smith, and *Ixodes scapularis* Say.

The host distribution represented by this survey is extensive and includes 17 species of birds and mammals. The ticks were taken mostly from trapped or shot animals; only a few specimens were dragged from grass or taken off people. The host distribution is as follows:

BIRDS[1]

Catbird, *Dumetella carolinensis* (Linnæus).—*Ixodes muris* (16 nymphs, 2 larvæ off 6 birds).

Brown thrasher, *Toxostoma rufum* (Linnæus).—*Ixodes muris* (9 n. off 1 bird).

Eastern or American robin, *Turdus migratorius migratorius* Linnæus.—*Ixodes muris* (22 n. off 2 birds).

Red-eyed towhee, *Pipilo erythrophthalmus erythrophthalmus* (Linnæus.)—*Ixodes muris* (18 n., 9 l. off 2 birds).

Eastern song sparrow, *Melospiza melodia melodia* (Wilson).—*Ixodes muris* (6 n., 1 l. off 3 birds).

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[1] Bequaert, J. C. 1946. *The Ticks or Ixodoidea, of the Northeastern United States and Eastern Canada.* Entomologica Americana, XXV, No. 2, pp. 73–232.

MAMMALS

Short-tailed shrew, *Blarina brevicauda aloga* Bangs.—*Dermacentor variabilis* (1 l. off 1 shrew); *Ixodes muris* (4 n., 9 l. off 6 shrews).

Long-tailed shrew, *Sorex parvus* (Say) (=*cinereus* True).—*Dermacentor variabilis* (1 l. off 1 shrew); *Ixodes muris* (6 l. off 1 shrew).

Raccoon, *Procyon lotor lotor* (Linnæus).—*Ixodes muris* (1 n. off 1 raccoon).

Skunk, *Mephitis nigra* (Peale and Beauvois).—*Dermacentor variabilis* (1 male, 3 females off 1 skunk); *Ixodes muris* (69 n. off 1 skunk).

Red fox, *Vulpes fulva* (Desmarest).—*Ixodes cookei* (5 n. off 1 fox); *Ixodes muris* (29 n., 1 l. off 1 fox).

Man (accidental host).—*Ixodes muris* (1 n., 1 l.); *Ixodes scapularis* (1 female).

Chipmunk, *Tamias striatus lysteri* (Richardson).—*Ixodes muris* (54 n. off 2 chipmunks).

Gray squirrel, *Sciurus carolinensis carolinensis* (Gmelin). *Dermacentor variabilis* (1 n. off 1 squirrel); *Ixodes muris* (125 n., 4 l. off 4 squirrels).

White-footed or deer mouse, *Peromyscus leucopus fusus* Bangs.—*Dermacentor variabilis* (17 n., 29 l. off 22 mice); *Ixodes muris* (138 n., 105 l. off 33 mice).

Meadow mouse, field mouse, or vole, *Microtus pennsylvanicus pennsylvanicus* (Ord.)—*Dermacentor variabilis* (6 n., 3 l. off 9 mice); *Ixodes muris* (5 females, 15 n., 12 l. off 10 mice).

Eastern cottontail rabbit, *Sylvilagus floridanus mearnsi* (Allen).—*Dermacentor variabilis* (1 male, 2 females, 1 n. off 3 rabbits); *Hæmaphysalis leporis palustris* (42 males, 18 females, 13 n., 14 l. off 9 rabbits); *Ixodes dentatus* (9 males, 12 females, 15 n., 2 l. off 8 rabbits); *Ixodes muris* (66 n., 34 l. off 7 rabbits).

Virginia deer, *Odocoileus virginianus borealis* (Miller). —*Ixodes muris* (18 n. off 1 deer).

Dragged from the grass.—*Dermacentor variabilis* (1 female); *Ixodes scapularis* (10 males, 4 females).

During this survey *Ixodes muris* has been observed and recorded for the first time from the long-tailed shrew, gray squirrel, Eastern cottontail rabbit, red fox, chipmunk, raccoon, skunk, Virginia deer, red-eyed towhee, catbird, Eastern or American robin, and brown thrasher. This makes twelve new hosts for the larval and nymphal forms of *Ixodes muris* Bishopp and Smith. Also recorded for the first time was the larval form of *Dermacentor variabilis* (Say) from the long-tailed shrew. This represents the first record of any species of tick taken from the long-tailed shrew in the Northeastern United States.

All identifications recorded for the first time were verified by Dr. Joseph C. Bequaert, Curator of Insects, Museum of Comparative Zoölogy, to whom the writer is indebted for his kind and valuable assistance.

SPHINDIDÆ AND CISIDÆ (COLEOPTERA)

During May, 1945, species of this family were found swarming in the small, crowded, woody fungi on standing dead and fallen trees and also stumps. There were many of what appears to be *Sulcacis lengi* Dury, *Cis fuscipes* Mellie, *Ennearthron thoracicorne* Zieg., *Octotemnus lævis* Csy., and *Sphindus americanus* Lec. They had about all disappeared by the end of June in Mass. About the same species and under the same conditions were found at Paris, Me., with the addition of *Urysphindus denticollis* Lec., which occurred in a flat, brown fungus of a soft smut-like consistency on a partly uprooted poplar in the woods. This has been taken before on the same species of fungus on the top of a stump at Monmouth, Me., June 27, 1912.—C. A. FROST.

AN INTERESTING OCEANIC SPECIES OF *CERIOIDES* (DIPTERA; SYRPHIDÆ)[1]

BY F. M. HULL
University of Mississippi

I am indebted to Dr. Joseph Bequaert, Curator of Insects at the Museum of Comparative Zoölogy, for calling my attention to the following interesting species of *Cerioides.*

Cerioides (Tenthredomyia) williamsi n. sp.

Related to *oceanica* Hull; differing in the pattern of the yellow markings.

Male. Length about 16 mm., including the downflexed abdomen, and including antennæ (2 mm.). *Head:* vertex and front shining black and almost bare. Upon the front there is on either side a sunken, hemicircular, opaque black pubescent, eye marginal area; at the upper end of this area there is a small patch of brownish-white pubescence. The face is dully shining black, with a sharp, wide, pale, yellow stripe on either side; this stripe margins the eyes on the upper half to the upper limits of the antennal pedicel, and below the stripe narrows as it is directed along the anterior, black cheek margins to the epistoma which it just fails to reach. The antennæ are entirely velvet black; the first segment is barely longer than the third, the third a trifle longer than the second; the pedicel is about as long as the second segment. *Thorax:* brilliant shining black with large, bright, pale yellow spots. These spots consist of the humeri, a spot on each side at the lateral end of the transverse suture (notopleural), a vertical spot covering most of the mesopleura, and all the scutellum except for a black, round, middle portion, which does not quite reach its posterior margin. *Abdomen:* broad at base, but little constricted, everywhere shining black, and with faint blue-purple luster apically. The narrow posterior mar-

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[1] Published by a grant from the Museum of Comparative Zoology at Harvard College.

gin of the second segment, and still more narrow margin of the third segment is pale yellow. The abdomen is strongly flexed downward beginning with the third segment, its extremely short, everywhere wholly appressed pile is white except broadly over the middle of the second segment where it is black. There is a small, lateral yellow spot on the sides of the first segment, scarcely discernible from above. *Legs:* blackish brown, nearly the basal half of all tibiæ whitish. All pile white; femoral setæ black, very sharp pointed. *Wings:* hyaline, the anterior border as far as the spurious vein very dark sepia brown, without evident lighter areas, even in the costal cell. Loop of third vein very shallow, and with a short spur.

Holotype: a male, Noumea, New Caledonia, October 16, 1940 (F. X. Williams). *Paratypes:* 2 males, La Foa, New Caledonia (C. L. Remington). Holotype in the Museum of Comparative Zoölogy (No. 27559). There is a paratype in the collection of the author and another in the Museum of Comparative Zoölogy.

Dr. Bequaert has kindly called my attention to the wasp which mimics this fly. The wasp model is *Pachymenes quodi* Vachall, a Eumenid. Mr. Williams, in the *Proceedings of the Hawaiian Entomological Society,* 1945, Vol. XII, plate xx, illustrates the fly and the wasp and calls attention to other mimics.

NOTES ON SPIDERS FROM PUERTO RICO[1]

BY ELIZABETH B. BRYANT
Museum of Comparative Zoölogy

Recently the Museum of Comparative Zoölogy received a small vial of spiders from the Luquillo Mountains in the eastern part of Puerto Rico, collected by Mr. Harry Beatty, at about 3,000 feet elevation. · It is a section of the island from which Dr. Petrunkevitch had little material when he published "The Spiders of Porto Rico," 1929–1930, so it is not surprising that among the fourteen species, four are new and three others have never been reported from the island before.

The following is a list of the species found. The asterisk (*) denotes the first time the species has been recorded from the island.

Family OÖNOPIDÆ

♂ *Stenoönops portoricensis* Petr.

Family THERIDIIDÆ

♂ ♀ **Allodipœna dianæ** spec. nov.
♀ *Conopistha argyrodes nephilæ* (Tacz.)
*♀ *Rhomphæa fictilum* (Hentz)

Family LINYPHIIDÆ

♀ *Erigone ?*

Family ARGIOPIDÆ

♂ *Argiope argentata* (Fabr.)
♂ **Tetragnatha parva** spec. nov.

Family THOMISIDÆ

*♂ *Misumenops bellulus* (Banks)

Family CLUBIONIDÆ

♀ *Clubiona desecheonis* Petr.
♀ *Wulfila immaculata* Banks

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[1] Published by a grant from the Museum of Comparative Zoology at Harvard College.

Family SALTICIDÆ

♀ **Agobardus blandus** spec. nov.
♂ ♀ **Habronattus pretiosus** spec. nov.
♀ *Hentzia antillanus* Bryant
*♂ *Sidusa mona* Bryant

Family THERIDIIDÆ

Genus **Allodipœna** gen. nov.

Cephalothorax almost as wide as long, anterior margin about half the greatest width, cephalic portion high, extending on the same level for more than half the length of the cephalothorax and then falling abruptly to the posterior margin, no thoracic groove or depression; *eyes*, anterior row recurved, a.m.e. separated by less than a diameter, posterior row slightly procurved, p.m.e. largest of the eight, about twice the diameter of a.m.e., separated by less than a diameter, lateral eyes touching; *maxillæ* about twice as long as the labium and inclined; *sternum* triangular, widest between the first coxæ, almost as wide as long, slightly convex, fourth coxæ separated by more than a diameter; legs, 1–2–4–3, quite short, with no spines.

Genotype *Allodipœna dianæ* spec. nov.

The genus *Allodipœna* differs from the genus *Dipœna* by the small anterior median eyes and the quite different quadrangle. It differs from the genus *Theridion* by the high cephalic portion, the large posterior median eyes, the convex sternum and the relatively short legs.

Allodipœna dianæ spec. nov.

Figures 1, 2, 3, 4

Female. Length, 1.5 mm., ceph. 0.6 mm., abd. 0.8 mm. long, 1.2 mm. wide.

Cephalothorax pale greenish-yellow with a large median shield-shaped dark spot that anteriorly is carried by curved lines to the lateral eyes, three-quarters as wide as long, anterior margin broad, cephalic portion high and extending on the same level for more than half the length of the cephalothorax and then falling abruptly to the posterior margin, no thoracic groove; *eyes,* anterior row recurved, a.m.e. convex, diurnal, separated by about a diameter and from a.l.e. by a little less, a.l.e. smaller than a.m.e., posterior row procurved, p.m.e. a broad oval, largest of the eight, heavily ringed with red, separated by less than a diameter and from p.l.e. by fully a diameter and a half, lateral eyes touching, p.l.e. larger than a.l.e.; *quadrangle* wider in front and higher than wide; *clypeus* vertical, and not as high as the quadrangle; *mandibles* vertical and weak; *labium* dark, wider than long; *maxillæ* pale, about twice as long as labium and inclined so that the tips are almost touching; *sternum* pale, triangular, almost as wide as long, (2.5: 3.0), widest between the first coxæ, convex, fourth coxæ separated by more than a diameter; *abdomen* wider than long, white, with a large dark basal spot and a pair of small dark, widely separated dots on the posterior half, wide dark lateral stripes which converge at the spinnerets, abdomen smooth with no hairs or bristles, venter pale; legs, 1–2–4–3, I right missing, quite short, pale, femora with a wide distal dark band, more distinct on the posterior pairs, I and II tibiæ with 3 dark ventral spots, metatarsi with 2 ventral spots, no spines, but rows of colorless hairs, longest on the posterior pairs; *epigynum,* two dark sacs beneath the surface, separated by less than a diameter.

Male. Length, 1.0 mm.

Cephalothorax pale brown, with no dark marks found in the female, anterior margin little more narrowed than in the female, cephalic portion high, almost as wide as long, no thoracic groove or depression, but a few long bristles on the median line; *eyes* more closely grouped than in the female, anterior row recurved, eyes equidistant, a.m.e. separated by less than a diameter, posterior row almost straight, eyes equidistant, p.m.e. largest of the eight, surrounded by red, separated by about half a diameter, lateral eyes on a common tubercle; *quadrangle* narrower in front and higher than wide; *clypeus* about as high as quadrangle; *mandibles* long and narrow; *labium* wider than long, fused to the sternum; maxillæ and the sternum as in the female; *abdomen* oval, two-thirds as wide as long, pale yellow with a vague gray median stripe on the posterior half, with scattered long bristles, venter pale, with the fold only slightly anterior to the middle; *legs,* IV pair missing, pale, with no spines but rows of hairs; *palpus,* left palpus missing, not as long as the cephalothorax, very simple and best understood from the figure.

Holotype ♀ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Allotype ♂ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

The male and female differ in size, shape and color markings, but they probably belong together as they have the same three structural characters that are unusual in the Theridiidæ, the posterior median eyes the largest, the convex sternum and the relatively short legs. The female is quite conspicuous with the distinct dark markings on the cephalothorax and the abdomen, and the abdomen much wider than long.

Family Argiopidæ

Genus *Tetragnatha* Latreille 1804

Tetragnatha parva spec. nov.

Figures 5, 8

Male. Length, 3.0 mm., without mandibles, ceph. 1.1 mm. long, 0.8 mm. wide, abd. 2.0 mm. long, 0.6 mm. wide.

Cephalothorax a deep yellow, anterior margin little narrowed, cephalic portion slightly raised, no thoracic groove but a slight transverse depression; *eyes* cover the anterior margin, each eye heavily ringed with black, anterior row slightly recurved, a.m.e. separated by less than a diameter, a.l.e. very small, posterior row recurved, eyes subequal with a.m.e., p.m.e. separated by little more than a diameter and from p.l.e. by about a diameter and a half, lateral eyes on separate tubercles that touch at the base but the eyes are separated by more than a diameter of p.l.e.; *quadrangle* narrower in front and wider behind than high; *clypeus* almost wanting below a.m.e.; *mandibles* porrect, basal two-thirds swollen, with a sharp tooth or cusp at the end of the swollen area, fang groove oblique, upper margin with three sharp teeth near the base of the fang, followed by a much smaller tooth, lower margin with one small tooth opposite the group of three teeth on the upper margin, fang long and curved; *labium* pale, about as wide as long, tip rebordered; *maxillæ* pale, two and a half times as long as the labium, sides parallel; *sternum* pale brown, triangular, widest between the first coxæ, pointed between the fourth coxæ; *abdomen* pale, with a darker branched median stripe, darker at the tip than at the base, about three times as long as wide, cylindrical, venter pale, spinnerets at the tip; *legs,* 1–2–4–3, anterior pairs much longer than the posterior pairs, pale, distal joints darker, no spines and few hairs; *palpus* longer than the cephalothorax, basal joints white, tibia very little longer than the patella, palpus of the usual *Tetragnatha* type, paracymbium about reaches the tip of the bulb, embolus rests on the conductor that is as long as the cymbium.

Holotype ♂ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1914 (Beatty).

Paratype ♂ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Tetragnatha parva is much smaller than the other species of the genus found in the Caribbean. Like *T. tenuissima* Cambr., it has no spines on the legs, but the most unusual character is the few teeth on the margin of the fang groove, with the absence of the "large tooth" usually found on the upper margin. The tubercles of the lateral eyes touch at the base, but the eyes are distinctly separated.

Family SALTICIDÆ

Genus *Agobardus* Keyserling 1884

Agobardus blandus spec. nov.

Figure 6

Female. Length, 3.0 mm., ceph. 1.6 mm. long, 1.2 mm. wide, abd. 1.6 mm. long, 1.2 mm. wide.

Cephalothorax, a dark shining brown with a pale median stripe from the thoracic groove to the posterior margin, in life this stripe probably covered with white scales as a few remain, a few white scales about the eyes, a narrow marginal stripe of white scales from the second coxæ to the posterior margin, cephalothorax high, sloping gradually from the groove to the posterior margin, anterior margin very little narrowed, thoracic groove short in a semi-circular depression between the dorsal eyes; *eyes,* anterior row covers the margin, recurved by the upper margins, a.m.e. very large, separated by a line, a.l.e. less than a radius of a.m.e. and separated from them by a line, second row of eyes midway between the first and third rows, dorsal eyes on the extreme margin of the carapace and slightly larger than a.l.e.; *quadrangle* same width in front as behind; *clypeus* about wanting below a.m.e., with a fringe of white hairs and a long recurved bristle between the a.m.e.; *mandibles* dark brown, vertical, no hairs or scales, fang groove short and oblique, upper margin with two small teeth, lower margin with a plate with two cusps, fang short; *labium* brown, slightly longer than wide, tip rebordered; *maxillæ* pale, almost twice as long as labium; *sternum* pale, almost as wide as long, (4.0:4.5), first coxæ separated by more than a diameter, fourth coxæ almost touching; *abdomen* oval, about two-thirds as wide as long, pale, with a pair of wavering dark stripes which end at a narrow curved cross band just above the spinnerets, and a pair of lateral dark stripes which join the median pair above the cross bar and reach the spinnerets, the entire abdomen covered with short white hairs, venter pale with a pair of widely separated black spots just anterior to the spinnerets, spinnerets long and closely grouped; *legs,* I pair missing, 4–3–2, pale, II femur with a large prolateral dark spot, posterior femora with a dark basal dorsal spot, and a distal dark ring, spines, II pair, patella, prolateral, 1, tibia, ventral, 2–2–2, prolateral, 3, retrolateral, 1, metatarsus, ventral, 2–2, basal pair very long, lateral, 2; epigynum only faintly chitinized, a pair of circular sacs beneath the surface, not quite touching, best understood from the figure.

Holotype ♀ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Agobardus blandus is probably related to *Agobardus tetuani* (Petr.) (Emathis), from Tetuan Mountain, near Jayuya and also from Rio Piedra, Puerto Rico. The latter species has five cusps on the plate of the fang groove, and the cephalothorax has a large pale lateral spot each side. The abdominal dark marks also, differ. It is not impossible, that each mountain has a distinct species of this genus.

Genus *Habronattus* F.O.P.-Cambridge 1901

Habronattus pretiosus spec. nov.

Figures 7, 9

Male. Length, 3.6 mm., ceph. 2.0 mm. long, 1.5 mm. wide, abd. 1.6 mm. long, 1.1 mm. wide.

Cephalothorax dark brown, ocular area thickly covered with white iridescent scales and longer dark bristles with the posterior margin between the dorsal eyes sharply defined by a dark band, curved lateral stripes of the white scales from the dorsal eyes to the posterior slope where they end abruptly, a broad marginal stripe of white scales ending abruptly above the second pair of legs, cephalic portion high, gradually rising to the thoracic groove when it falls gradually until about one-fifth from the posterior margin where it drops rapidly, widest posterior to the second pair of legs, thoracic groove short, in a semicircular depression, in a line between the dorsal eyes; *eyes*, anterior row recurved, so that the upper margins form a straight line, a.m.e. separated by a line, and from a.l.e. by a little more, a.l.e. about one-half a diameter of a.m.e., eyes of second row very small and midway between the first and third rows, dorsal eyes slightly larger than a.l.e.; *quadrangle* slightly wider behind than in front; *clypeus* about as wide as a diameter of a.m.e., thickly covered with white scales which join with the marginal stripe that ends at the second pair of legs; *mandibles* brown, small, vertical, fang groove very short, upper margin with three contiguous teeth, lower margin with one tooth; *labium* brown, as wide as long; *sternum* oval, margins dark and center pale, I coxæ separated by less than a diameter, IV coxæ touching, the dark area with long white hairs;

abdomen oval, with a white basal band that continues as lateral stripes to the spinnerets, a pair of dark stripes that unite above the spinnerets with inner margins irregular, leaving a pale median stripe, venter with three dark stripes united in front of the spinnerets by a short dark band; *legs,* 3–4–1–2, I pair heaviest, dark brown, with a distinct prolateral darker stripe on the femur, patella and tibia, the dark area on the femur flattened, II, III and IV pairs pale, with dark rings at the base and distal ends of femur and tibia, patella with a pair of dark spots near tip, spines, I pair, patella, 0, tibia, ventral, 2–2,1r, metatarsus, ventral, 2–2, III and IV tibiæ with a dorsal, basal spine and a ventral retrolateral spine near the base; *palpus* not as long as cephalothorax, femur and patella with white iridescent scales on the dorsal side, tibia and cymbium dark, with coarse dark hairs, tibia not as long as patella, tibial apophysis dark, shining and pressed close to the cymbium, palpal organ of the usual type with the outer process longer and starting from the side and ending in a slender tip at the end of the cymbium, the inner process heavier, starts about the middle of the bulb and ends about opposite to its origin.

Female. Length, 3.0 mm., ceph. 1.6 mm. long, 1.1 mm. wide, abd. 1.9 mm. long, 1.2 mm. wide.

Cephalothorax dark chestnut-brown, ocular area thinly covered with golden iridescent scales which continue in parallel lateral stripes from the dorsal eyes and end abruptly above the posterior margin, these lateral stripes are shorter than in the male, marginal stripe of white scales on the posterior margin only, cephalothorax high, sides not as much rounded as in the male, thoracic groove short, in a semi-circular depression; *eyes* as in the male; *clypeus* equals about half a diameter of a.m.e., brown, with scattered golden scales, palpus, femur and patella covered with white scales; *mandibles* brown, vertical, mouth parts as in the male; *sternum* brown; *abdomen* with three dark triangles, one median and basal, and the other two lateral, just posterior to the middle, posterior to the basal triangle, a transverse pale band of white iridescent scales, the median area between the dark lateral triangles pale brown, with vague chevrons on the posterior half, ventor pale with a large dark rectangle from the fold to the spinnerets; *legs*, 3-4-1-2, pale, femora with ventral distal and basal dark spots, spines as in the male; *epigynum* with the parts only lightly chitinized, a pair of widely separated spermatheca beneath the surface in the posterior part, anteriorly, a pair of oblique oval sacs with a small dark spot at the tips which probably are openings, middle area a circular depression, best understood from the figure.

Holotype ♂ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Allotype ♀ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

Paratypes ♂ 2 ♀ Puerto Rico; Luquillo Mountains, 3,000 feet, July 1944 (Beatty).

The male and female *Habronattus pretiosus* have several characters in common as do several other species of the genus. Both have the eye area covered with scales, white in the male and golden in the female; the legs have the same dark ventral spots on the femora but only the male has the prolateral surface of the first femur flattened and covered with white scales. The lateral stripes of iridescent scales on the cephalothorax that end abruptly on the posterior slope are very conspicuous and are common to both male and female. The flattened area on the first femur of the male has not been seen before in the genus and is very conspicuous.

LITERATURE CITED

Banks, N. 1896. New North American Spiders and Mites. Trans. American Ent. Soc., 23, pp. 57–77.

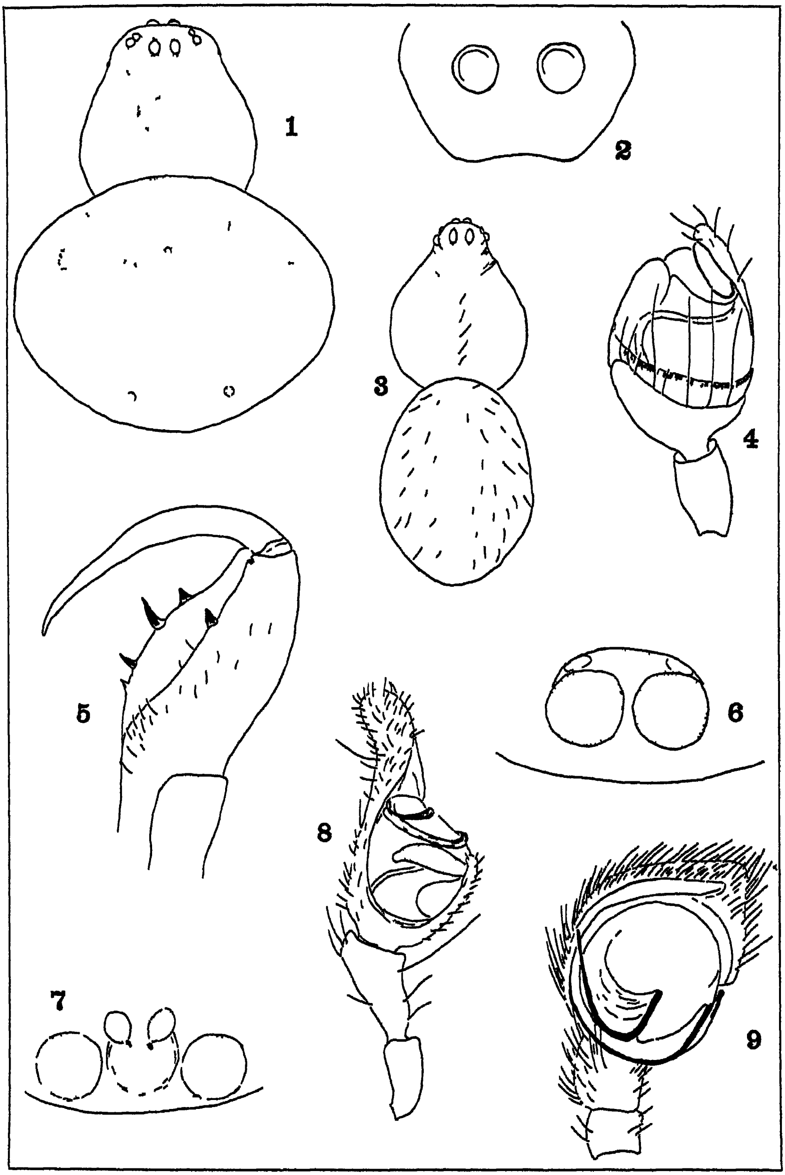
Bryant, Elizabeth B. 1947. Spiders of Mona Island. Psyche, vol. 54, pp. 86–99, 1 plate.

Petrunkevitch, Alexander. 1929–1930. The Spiders of Porto Rico. Trans. Conn. Acad., pt. 1, 30, pp. 1–158, 150 figs.; pt. 2, 30, pp. 159–358, 240 figs., pt. 3, 1930, 31, pp. 1–191, 168 figs.

EXPLANATION OF PLATE

Fig. 1. *Allodipœna dianœ* spec. nov., female, dorsal.
Fig. 2. *Allodipœna dianœ* spec. nov., epigynum.
Fig. 3. *Allodipœna dianœ* spec. nov., male, dorsal.
Fig. 4. *Allodipœna dianœ* spec. nov., right palpus.
Fig. 5. *Tetragnatha parva* spec. nov., left mandible, ventral.
Fig. 6. *Agobardus blandus* spec. nov., epigynum.
Fig. 7. *Habronattus pretiosus* spec. nov., epigynum.
Fig. 8. *Tetragnatha parva* spec. nov., left palpus.
Fig. 9. *Habronattus pretiosus* spec. nov., left palpus.

PSYCHE, 1947 VOL. 54, PLATE 16



BRYANT—SPIDERS FROM PUERTO RICO

CATALOGUE OF RECENT AND FOSSIL NEMESTRINIDÆ OF AMERICA NORTH OF MEXICO

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The present compilation arranges all published references of North American Nemestrinidæ, known to the author, so as to present a reliable key to the literature and a clear historical view of the subject. All citations have been checked with the originals. The actual date of publication follows the author's name while any other date mentioned in connection with the work is inserted in parentheses after the abbreviated title and volume number. The type localities and present location of the types are noted with the original descriptions of either sex. Other references mention localities based on new material, as well as important biological data. I have used the opportunity to publish additional localities for some of the forms.

The abbreviations have been chosen so that even the beginner and non-specialist will be able to trace them in the literature. In my experience Catalogues are more useful to the uninitiated than to the strict specialist. The following abbreviations are used for the depositories of types: A.M.N.H. for American Museum of Natural History, New York; Brit. Mus. for British Museum (Natural History), London; Kansas Un. for Department of Zoölogy and Entomology, University of Kansas, Lawrence, Kansas; M.C.Z. for Museum of Comparative Zoölogy, Cambridge, Massachusetts; Melander Coll. for private collection of A. L. Melander, now at Riverside, California; Painter Coll. for private collection of R. H. Painter, now at Manhattan, Kansas; Peabody Mus. for Peabody Museum of Yale University, New Haven, Connecticut; U. Colo. Mus. for Museum of the University of Colorado, Boulder, Colorado; and U.S.N.M. for United States National Museum, Washington, D. C.

The Catalogue covers the Dominion of Canada and the United States, no species being known from Alaska. This area includes the major part of the Nearctic Region, which, as is well known, extends some distance into Mexico, its southern boundary being irregular and often disputed. Two of the species here listed are known also from farther south, extending to Guatemala in one case and to Panama in the other. Moreover, most probably some of the other forms will also be taken eventually south of the Mexican border. On the other hand, three additional species, *Neorhynchocephalus mexicanus* Bequaert, *Hirmoneura* (*Neohirmoneura*) *psilotes* Osten Sacken, and *Hirmoneura* (*Hyrmophlæba*) *brevirostris* Macquart, are known from Mexico and Central America. One or more of these might possibly yet be discovered in the southwestern United States. With this reservation, it is doubtful whether many additions will be made in the future to the Recent Catalogue. In any case, such additions will not alter appreciably the general character of the fauna.

Even if we include the Mexican and Central American forms, the Nearctic nemestrinid fauna is very scant, consisting of only nine species and one subspecies. These are now placed in three subfamilies and three genera, an unusually high proportion of supra-specific groups. All the species are precinctive; while one of the three genera only (*Neorhynchocephalus*) is strictly American, occurring as far south as Argentina. The other two genera (*Hirmoneura* and *Trichopsidea*) are nearly cosmopolitan; but the Nearctic species belong to peculiarly American subgenera (*Neohirmoneura, Hyrmophlæba,* and *Parasymmictus*).

Throughout the world the majority of Recent Nemestrinidæ occur in five widely separated areas: the Nearctic Region; the warm temperate areas of Chile and Argentina; the Mediterranean subregion and Central Asia; Africa south of the Zambesi; and Australasia. In point of number of species, the Nearctic Region is the poorest of these five areas. The Recent North American members of the family appear to be remnants of what may have been a flourishing fauna at some earlier geological period. This is strongly suggested by the relatively rich fossil fauna. One set of Miocene strata in one locality has now yielded five species, belonging to at least three genera, one of the latter no longer found in the New World. The fact that only one fossil species is known outside North America makes this even more remarkable. Bequaert and Carpenter (1936) have commented upon the astonishing similarity between the Miocene and Recent Nemestrinidæ. The evolution of the family seems to have been at a standstill since mid-Tertiary times, which also points to the great antiquity of the group.

RECENT SPECIES

Family NEMESTRINIDÆ

Nemestrinidæ Macquart, 1834, Hist. Nat. Ins. Dipt., I, p. 370.
Fallenina Rondani, 1856, Dipt. Italicæ Prodr., I, p. 33 and 161.
Nemestrinidii Bigot, 1856, Ann. Soc. Ent. France (3) IV, pp. 63 and 85.
Nemestrinites Walker, 1857, Trans. Ent. Soc. London (N. S.) IV, pt. 5, p. 133.
Hirmoneuridæ H. Loew, 1860, Abh. Naturw. Ver. Halle, II, pt. 2, pp. ix and 317 (Dipteren-Fauna Südafrikas, I, pp. ix and 245).
Nemistrinidæ Williston, 1883, Canad. Entom., XV, p. 69.

Subfamily HIRMONEURINÆ

Hirmoneurina H. Loew, 1860, Abh. Naturw. Ver. Halle, II, pt. 2, p. ix (Dipteren-Fauna Südafrikas, I, p. ix).
Hirmononeurina H. Loew, 1860, Abh. Naturw. Ver. Halle, II, pt. 2, p. 318 (Dipteren-Fauna Südafrikas, I, p. 246).
Hirmoneurinæ Bequaert, 1930, Psyche, XXXVII, p. 295.

Hirmoneura Meigen

Hirmoneura Meigen, 1820, Syst. Beschr. Europ. Zweifl.

Ins., II, p. 132 (monotypic for *Hirmoneura obscura* Wiedemann, 1820).

Hirmonevra Blanchard, 1840, in Brullé, Hist. Nat. Anim. Articulés, III, p. 387 (emendation of *Hirmoneura;* same type).

Hyrmoneura Rondani, 1864, Arch. Zool. Modena, III, p. 50 (misspelling of *Hirmoneura;* same type).

Hermoneura Philippi, 1865, Verh. Zool. Bot. Ges. Wien, XV, p. 655, footnote (emendation of *Hirmoneura;* same [subg.] type).

clausa Osten Sacken. See *Trichopsidea.*

Subgenus *Neohirmoneura* Bequaert

Hirmoneura subg. *Neohirmoneura* Bequaert, 1920, Jl. New York Ent. Soc., XXVII (for 1919), p. 306 (type by original designation: *Hirmoneura flavipes* Williston, 1886).

1. *H.* (*Neohirmoneura*) *bradleyi* Bequaert.

Hirmoneura (*Neohirmoneura*) *bradleyi* Bequaert, 1920, Jl. New York Ent. Soc., XXVII (for 1919), p. 301, fig. (on p. 302) (holotype ♀ and allotype ♂: Anhalt, Comal Co., Texas.—Both A.M.N.H.; paratypes: Helotes, Bexar Co., Texas).

Hirmoneura bradleyi Hull, 1923, Ent. News, XXXIV, p. 277 (Texas: Bee Creek Canyon near Austin; Austin). Bequaert and Carpenter, 1936, Jl. of Paleontology, X, p. 396, fig. 1.

Distr.: Tex.

2. *H.* (*Neohirmoneura*) *flavipes* Williston.

Hirmoneura flavipes Williston, 1886, Trans. Amer. Ent. Soc., XIII, p. 292 (holotype ♀: "United States."—Kansas Un.). Johnson, 1895, Proc. Ac. N. S. Philadelphia, XLVII, p. 325 ("Florida"; erroneous locality). Aldrich, 1905, Smithson. Misc. Coll., XLVI, No. 1444, p. 218. Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, pp. 251 and 252 (erroneously given as ♂). Lichtwardt, 1910, Deutsch. Ent. Zeitschr., p. 589. Schaeffer, 1912, Jl. New York Ent. Soc., XX, p. 296 (Arizona: Huachuca Mts.). Johnson, 1913, Bull. Amer. Mus. Nat. Hist., XXXII, p. 54 ("Florida"; erroneous locality). Hunter, 1914, Kansas Un. Sci. Bull., VIII, pt. 1, p. 19 (type in Snow Coll., Kansas Un.).

Hermoneura flavipes Kertész, 1909, Cat. Dipt., IV, p. 26.

Hirmoneura (*Neohirmoneura*) *flavipes* Bequaert, 1920, Jl. New York Ent. Soc., XXVII (for 1919), p. 306 (♀♂); 1934, *op. cit.*, XLII, p. 176 (allotype ♂: Huachuca Mts., Cochise Co., Arizona.—M.C.Z. Also Arizona: Pinery Canyon, Chiracahua Mts., 6,500 ft., Cochise Co.; Post Creek Canyon, Pinaleño Mts., Fort Grant, 6,000 ft., Graham Co.).

Distr.: Ariz.

Subgenus *Hyrmophlœba* Rondani

Hyrmophlœba Rondani, 1864, Arch. Zool. Modena, III, p. 51 (monotypic for *Hirmoneura brevirostris* Macquart, 1845).

Hirmophlœba Bigot, 1881, Ann. Soc. Ent. France, (6) I, p. 17 (misspelling of *Hyrmophlœba;* same type).

Hyrmophlœba Curran, 1934, Fam. Gen. North Am. Dipt., p. 202 (misspelling of *Hyrmophlœba;* same type).

Hirmophlœba Curran, 1934, Fam. Gen. North Am. Dipt., p. 202 (misspelling of *Hyrmophlœba;* same type).

3. *H.* (*Hyrmophlœba*) *texana* Cockerell.

Hirmoneura texana Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 253 (holotype ♂: New Braunfels, Texas.—Melander Coll.) [1908, Amer. Jl. Sci., (4) XXV, p. 311, fig. (on p. 310); as *Hirmoneura* B]; 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286. Lichtwardt, 1910, Deutsch. Ent. Zeitschr., p. 591.

Hyrmophlœba texana Bequaert, 1920, Jl. New York Ent. Soc., XXVII, (for 1919), p. 306.

Hirmoneura (*Hyrmophlœba*) *texana* Bequaert, 1934, Jl. New York Ent. Soc., XLII, p. 178 (allotype

♀: Helotes, Bexar Co., Texas.—M.C.Z. Also Texas: Nueces R., Uvalde Co.; Sabinal R., Uvalde Co. Arizona: Post Creek Canyon, Pinaleño Mts., Fort Grant, 6,000 ft., Graham Co.

Hirmophlœba texana Curran, 1934, Fam. Gen. North Am. Dipt., p. 202, figs. 3–4.

Distr.: Tex., Ariz. Also Panama (Tapia, collected by G. Fairchild).

3*a*. *H.* (*H.*) *texana* var. *arizonensis* Bequaert.

Hirmoneura (*Hyrmophlœba*) *texana* var. *arizonensis* Bequaert, 1934, Jl. New York Ent. Soc., XLII, p. 180 (holotype ♂: San Diego Canyon, Baboquivari Mts., 25 miles SE of Sells, Pima Co., Arizona.—Painter Coll.; allotype ♀: Baboquivari Mts., Pima Co., Arizona.—Kansas Un.).

Additional Record.—Arizona: Tucson, many ♀♂, September 3 (F. M. Carpenter).

Distr.: Ariz.

Subfamily NEMESTRININÆ

Rhynchocephalina H. Loew, 1860, Abh. Naturw. Ver. Halle, II, pt. 2, p. x (Dipteren-Fauna Sudafrikas, I, p. x).

Nemestrininæ Bequaert, 1930, Psyche, XXXVII, p. 286.

Neorhynchocephalus Lichtwardt

Neorhynchocephalus Lichtwardt, 1909 (July), Deutsch Ent. Zeitschr., p. 512 (for 2 species; type by designation of Bequaert, 1930: *Rhynchocephalus volaticus* Williston, 1883).

Rhynchocephalus subg. *Nemestrinopsis* Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 285 (type by original designation: *Rhynchocephalus volaticus* Williston, 1883).

1. *N. sackenii* (Williston).

Rhynchocephalus sackenii Williston, 1860, Trans. Conn. Ac. Sci., IV, p. 243, fig. (holotype ♀: Olympia, State of Washington.—Kansas Un.). Hine, 1904, Canad. Entom., XXXVI, pp. 86 and

90 (British Columbia: Vernon). Schaeffer, 1912, Jl. New York Ent. Soc., XX, p. 296 (Arizona: Huachuca Mts.).

Rhynchocephalus sackeni Williston, 1883, Canad. Entom., XV, pp. 70 and 71 (allotype ♂: State of Washington.—Kansas Un.); 1894, Ent. News, V, p. 47 (oviposition. Colorado: Colorado Springs). Snow, 1903, Kansas Un. Sci. Bull., II, pt. 5, p. 214 (Kansas: Clark Co.; Morton Co.). Aldrich, 1905, Smithson. Misc. Coll., XLVI, No. 1444, p. 219. Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 249, Pl. XVI, figs. 1 and 3 (Colorado: Ft. Collins). Kertész, 1909, Cat. Dipt., IV, p. 30. Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286. Hunter, 1914, Kansas Un. Sci. Bull., VIII, pt. 1, p. 19 (type in Snow Coll., Kansas Un). Gibson, 1916, 46th Ann. Rept. Ent. Soc. Ontario (for 1915), p. 211. Cole and Lovett, 1921, Proc. Calif. Ac. Sci., (4) XI, p. 239 (Oregon: Forest Grove; Mary's Peak; Corvallis; Lewisburg; Union Co.). Robertson, 1928, Flowers and Insects, p. 47 (Illinois: Carlinville, at fl. of *Achillea millefolium*). Curran, 1931, Canad. Entom., LXIII, pp. 69 and 72 (California).

Neorhynchocephalus sackeni Lichtwardt, 1909, Deutsch. Ent. Zeitschr., p. 512; 1910, *op. cit.*, p. 593 (♂♀). Bequaert, 1930, Psyche, XXXVII, p. 291 (♀♂. State of Washington: Yakima River; Rock Lake. Oregon: Mt. Angel. California: Goose Lake, Medoc Co. Idaho: Grangeville; Whitebird. Utah: Mill Creek; Salt Lake City. Colorado: Boulder. New Mexico: West Canyon Camp, Koehler); 1932, Zoolog. Anzeiger, C, p. 33. James, 1938, Jl. Kansas Ent. Soc., XI, p. 21 (Colorado: Boulder; Masonville; Spring Canyon, Fort Collins; Horsetooth Gulch, Fort Collins; Crystal Springs Country Club, Flagler; Fort Collins). Spencer, 1945, Proc. Ent. Soc. British Columbia, XLII, p. 18 (British Columbia: Kamloops. Bred from *Melanoplus m. mexicanus;* descr. of larva).

Neorhynchocephalus sackenii Bequaert, 1934, Jl. New York Ent. Soc., XLII, pp. 165 and 169 (♀♂; oviposition. State of Washington: Spanaway, Pierce Co.; Roy, Pierce Co. Oregon: Salem, Marion Co. Utah: Mt. Buncombe near Logan, Cache Co., 10,000 ft. Kansas: Manhattan, Riley Co.; Medora, Reno Co.; Kiowa Co.; Scott Co.; Cheyenne Co.; Norton Co.; McPherson Co. Oklahoma: Lawton, Comanche Co. Arkansas: Springdale, Washington Co. Michigan: Douglas Lake, Cheboygan Co.).

Rhynchocephalus subnitens Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 250 (holotype ♀: Clark Co., Kansas, 1,960 ft.—Melander Coll.); 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286. Schaeffer, 1912, Jl. New York Ent. Soc., XX, p. 296 (Arizona: Huachuca Mts.). Curran, 1931, Canad. Entom., LXIII, pp. 69 and 72.

Neorhynchocephalus subnitens Lichtwardt, 1910, Deutsch. Ent. Zeitschr., p. 593.

Rhynchocephalus clausus Brauer, 1880, Offenes Schreiben Antwort Osten Sacken's "Critical Review," p. 8 (Colorado). Not of Osten Sacken, 1877.

Additional Records.—Oregon: Bush's Pasture, Salem (G. F. Smith); [also Sparta, Baker Co., according to T. H. G. Aitken, *in litt.*]—California: Santa Cruz.

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2. *N. volaticus* (Williston).

Rhynchocephalus volaticus Williston, 1883, Canad. Entom., XV, pp. 70 and 71, fig. 4 (described from 2 ♀ cotypes, from "Florida"; the type locality is Georgiana, Florida, according to Bequaert, 1934, Jl. New York Ent. Soc., XLII, p. 167, footnote.—Lecto-holotype at Kansas Un; cotype at U.S.N.M.); 1886, Trans. Amer. Ent. Soc., XIII, p. 293 (descr. corrected); 1888, Synopsis North Amer. Dipt., p. 33, fig. Johnson, 1895, Proc. Ac. Nat. Sci. Philadelphia, XLVII, p. 325 (Florida:

St. Augustine). Aldrich, 1905, Smithson. Misc. Coll., XLVI, No. 1444, p. 219. Williston, 1908, Manual North Amer. Dipt., 3d Ed., p. 186, fig. 68. Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 250. Kertész, 1909, Cat. Dipt., IV, p. 30. Hunter, 1914, Kansas Un. Sci. Bull., VIII, pt. 1, p. 19 (type in Snow Coll., Kansas Un.). Curran, 1931, Canad. Entom., LXIII, pp. 69 and 72.

Neorhynchocephalus volaticus Lichtwardt, 1909, Deutsch. Ent. Zeitschr., p. 512; 1910, *op. cit.*, p. 593, fig. 2 (on p. 592). Johnson, 1913, Bull. Amer. Mus. Nat. Hist., XXXII, p. 54. Hull, 1923, Ent. News, XXXIV, p. 275 (Mississippi: A. and M. College near Starkville; West Point. Texas: Kingsville; Raymondville). Bequaert, 1930, Psyche, XXXVII, p. 290 (Texas: Cotula; Nueces R. Kansas: Bourbon Co., 800 ft.; Sumner Co., 1189 ft.; Lawrence; Douglas Co.); 1934, Jl. New York Ent. Soc., XLII, pp. 165 and 166, figs. 1E–G (on p. 172) (Kansas: Atchison Co.; Morris Co.; Medicine Lodge, Barber Co.; Onaga, Pottawatomie Co.; Riley Co.; Cowley Co.; Doniphan Co.; Saline Co.; Manhattan, Riley Co.; Leavenworth Co.; Dickinson Co. Oklahoma: Arbuckle Mts., Murray Co. Florida: Sanford, Seminole Co.; Wildwood, Sumter Co. Missouri: Hollister, Taney Co. Arizona: San Diego Canyon on west side of Baboquivari Mts., 25 miles SE of Sells, Pima Co. At fl. of *Houstonia* in Kansas; descr. pupa). Curran, 1934, Fam. Gen. North Am. Dipt., p. 202, figs. 5–6.

Rhynchocephalus (*Neorhynchocephalus*) *volaticus* Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, pp. 285 and 286.

Rhynchocephalus maculatus Curran, 1931, Canad. Entom., LXIII, p. 69 (cotypes ♀♂: Lawrence, Kans.—Kansas Un.).

Rhynchocephalus flavus Curran, 1931, Canad. Entom., LXIII, pp. 69 and 70 (holotype ♂: Harper Co., Kansas; allotype ♀: Sumner Co., Kansas.—Both Kansas Un. Also paratypes Kansas: Bourbon Co.; Cherokee Co.; Waubaunsee Co.).

Additional Records.—Florida: Indian River (Whitfeld); Monticello (G. Fairchild).—Missouri: Willard, Greene Co. (A. E. Brower).

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Rhynchocephalus Fischer, 1806

clausus Brauer (not Osten Sacken). See *Neorhynchocephalus sackenii.*
flavus Curran. See *Neorhynchocephalus volaticus.*
maculatus Curran. See *Neorhynchocephalus volaticus.*
sackenii Osten Sacken. See *Neorhynchocephalus.*
subnitens Cockerell. See *Neorhynchocephalus sackenii.*
volaticus Williston. See *Neorhynchocephalus.*

Subfamily TRICHOPSIDEINÆ

Trichopsideinæ Bequaert, 1932, Zoolog. Anzeiger, C, p. 33.

Trichopsidea Westwood

Trichopsidea Westwood, 1839, Trans. Ent. Soc. London, II, p. 151 (monotypic for *Trichopsidea oestracea* Westwood, 1839).

Subgenus *Parasymmictus* Bigot

Parasymmictus Bigot, 1879, Ann. Soc. Ent. France, (5) IX, Bull. Séances, p. lxvii (monotypic for *Hirmoneura clausa* Osten Sacken, 1877).

Parasymmyctus Curran, 1934, Fam. Gen. North Am. Dipt., p. 202 (misspelling of *Parasymmictus;* same type).

1. *T.* (*Parasymmictus*) *clausa* (Osten Sacken).

Hirmoneura clausa Osten Sacken, 1877, Bull. U. S. Geol. Survey, III, pt. 2, p. 225 (holotype ♂, erroneously given as ♀: Dallas, Texas.—M.C.Z.); 1878, Smithson. Misc. Coll., No. 270, pp. 85 and

237. Williston, 1883, Canad. Entom., XV, p. 70. Osten Sacken, 1898, Berlin. Ent. Zeitschr., XLII (for 1897), p. 148. Aldrich, Smithson. Misc. Coll., XLVI, No. 1444, p. 218.

Parasymmictus clausus Bigot, 1879, Ann. Soc. Ent. France (5) IX, Bull. Séances, p. lxvii; 1881, *op. cit.* (6) I, p. 15. Kertész, 1909, Cat. Dipt., IV, p. 31. Lichtwardt, 1910, Deutsch. Ent. Zeitschr., pp. 589 and 591. Johnson, 1913, Bull. Amer. Mus. Nat. Hist., XXXII, p. 54 (Florida: Beresford). Bequaert, 1920, Jl. New York Ent. Soc., XXVII (for 1919), p. 306. J. Comstock, 1924, Introduction to Entomology, p. 836, fig. 1077. Spencer, 1945, Proc. Ent. Soc. Brit. Columbia, XLII, p. 18 (British Columbia: Riske Creek, Chilcotin; Lac du Bois, Kamloops. Oviposition; descr. larva; bred from *Camnula pellucida* and other grasshoppers).

Hirmoneura (*Parasymmictus*) *clausa* Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 251; 1908, Amer. Jl. Sci. (4) XXV, p. 311, fig. (on p. 310); 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286.

Trichopsidea (*Parasymmictus*) *clausa* Bequaert, 1934, Jl. New York Ent. Soc., XLII, pp. 181 and 182 (Kansas: Medora, Reno Co.).

Parasymmyctus clausus Curran, 1934, Fam. Gen. North Am. Dipt., p. 202, figs. 1–2.

Rhynchocephalus sackeni J. and A. Comstock, 1895, Manual Study Insects, 1st. Ed., p. 460, fig. 555 (repeated in later editions of this work). Spencer, 1931, Proc. Ent. Soc. Brit. Columbia, XXVIII, p. 21, figs. (on p. 24) (British Columbia: Riske Creek, Chilcotin. Oviposition); 1932, *op. cit.*, XXIX, p. 25 (oviposition). Graham, 1932, Canad. Entom., LXIV, p. 167 (British Columbia. Variation). Not of Williston, 1880.

Rhynchocephalus sp. J. Comstock, 1918, The Wings of Insects, p. 347, fig. 358.

Distr.: Brit. Col., Kans., Tex., Fla.

FOSSIL SPECIES

Subfamily HIRMONEURINÆ

Hirmoneura Meigen

occultator Cockerell. See *Neorhynchocephalus.*
melanderi Cockerell. See *Neorhynchocephalus* (?).
vulcanicus Cockerell. See *Neorhynchocephalus.*

Subgenus *Hirmoneurites* Cockerell

Hirmoneurites Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, pp. 283 and 285 (monotypic for *Hirmoneurites willistoni* Cockerell, 1910).

1. *H.* (*Hirmoneurites*) *willistoni* (Cockerell).
   Hirmoneurites willistoni Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, pp. 283 and 286, fig. 3 (on p. 283) (no sex given; holotype: Florissant, Colorado.—A.M.N.H.).
   Hirmoneura (*Hirmoneurites*) *willistoni* Bequaert, 1932, Zoolog. Anzeiger, C, p. 15. Bequaert and Carpenter, 1936, Jl. of Paleontology, X, p. 399, figs. 2 (on p. 400) and 7 (2) (on p. 405) (holotype ♀).
   Distr.: Miocene of Colo.

Subfamily NEMESTRININÆ

Neorhynchocephalus Lichtwardt

1. *N. occultator* (Cockerell).
   Hirmoneura occultator Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 254 (no sex given; holotype: Florissant, Colorado.—Obverse at U. Colo. Mus.; reverse at Brit. Mus.). Bather, 1909, Proc. Geologists' Assoc., XXI, pt. 3, p. 162 (type at Brit. Mus.). Cockerell, 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286.
   Neorhynchocephalus occultator Bequaert and Carpenter, 1936, Jl. of Paleontology, X, pp. 399 and 402, figs. 4 (on p. 400) and 7 (1) (on p. 405) (obverse of type ♀).
   Distr.: Miocene of Colo.

2. *N. vulcanicus* (Cockerell).

Hirmoneura vulcanica Cockerell, 1908, Amer. Jl. Sci. (4) XXV, p. 311 (no sex given; holotype: Florissant, Colorado.—Obverse at Peabody Mus.; reverse at U. Colo. Mus.); 1908, Trans. Amer. Ent. Soc., XXXIV, pp. 251 and 253; 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286.

Neorhynchocephalus vulcanicus Bequaert and Carpenter, 1936, Jl. of Paleontology, X, pp. 399 and 401, figs. 3 (on p. 400) and 7 (4) (on p. 405) (obverse and reverse of type ♀).

Distr.: Miocene of Colo.

Generic Position Doubtful

3. *N.* (?) *melanderi* (Cockerell).

Hirmoneura melanderi Cockerell, 1908, Amer. Jl. Sci. (4) XXV, p. 311 (no sex given; holotype: Florissant, Colorado.—Obverse at Peabody Mus.; reverse at U. Colo. Mus.); 1908, Trans. Amer. Ent. Soc., XXXIV, pp. 251 and 253; Pl. XVI, fig. 4 (add. specimen, prob. ♀, Florissant); 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286.

Neorhynchocephalus (?) *melanderi* Bequaert and Carpenter, 1936, Jl. of Paleontology, X, pp. 399 and 403, figs. 5 (on p. 400) and 7 (3) (on p. 405) (obverse and reverse of type, of doubtful sex. Also 2 add. specimens, one ♂, Florissant, at M.C.Z.).

Distr.: Miocene of Colo.

Prosœca Schiner

Prosœca Schiner, 1867, Verh. Zool. Bot. Ges. Wien, XVII, pp. 306 and 311 (type by original designation: *Nemestrina westermanni* Wiedemann, 1821).

Subgenus *Palembolus* Scudder

Palembolus Scudder, 1878, Bull. U. S. Geol. Geogr. Surv. Terr., IV, p. 526 (monotypic for *Palembolus florigerus* Scudder, 1878).

Palombolus Handlirsch, 1907, Die Fossilen Insekten, pt. 7, p. 1009 (misspelling of *Palembolus*).

1. *P.* (*Palembolus*) *florigera* (Scudder).

Palembolus florigerus Scudder, 1878, Bull. U. S. Geol. Geogr. Surv. Terr., IV, pp. 519 and 528 (no sex given; holotype: Florissant, Colorado.—Obverse and reverse at M.C.Z.); 1885, in Zittel, Handbuch d. Palaeontologie, Abt. I, II, p. 808, fig. 1076; 1887, in Zittel, Traité de Paléontologie, Barrois Ed., II, p. 809, fig. 1093; 1890, Rept. U. S. Geol. Surv. Terr., XIII, p. 29. Zittel, 1895, Grundzüge d. Palaeontologie, p. 506, fig. 1380. Scudder, 1900, in Zittel, Text-Book of Palaeontology, Eastman Ed., I, pt. 2, p. 688, fig. 1567. Zittel, 1903, Grundzüge d. Palaeontologie, 2d Ed., I, p. 542, fig. 1400. Cockerell, 1908, Trans. Amer. Ent. Soc., XXXIV, p. 248; 1910, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 286. Scudder, 1913, in Zittel, Text-Book of Paleontology, 2d Eastman Ed., I, p. 816, fig. 1586.

Palombolus florigerus Handlirsch, 1907, Die Fossilen Insekten, pt. 7, p. 1009. Broili, 1915, in Zittel, Grundzüge d. Palaeontologie, I, p. 666, fig. 1454. Handlirsch, 1921, in Schröder, Handbuch d. Entomologie, III, p. 264, fig. 227.

Prosœca (*Palembolus*) *florigera* Bequaert and Carpenter, 1936, Jl. of Paleontology, X, pp. 399 and 406, figs. 6 (on p. 400) and 7 (5) (on p. 405) (obverse and reverse of type ♂).

Distr.: Miocene of Colo.

EIGHTH INTERNATIONAL CONGRESS OF ENTOMOLOGY

The eighth International Congress of Entomology will be held in Stockholm, Sweden, August 8–15, 1948. The fact that all steamship sailings are currently booked to capacity for months in advance makes it seem necessary for those expecting to attend the congress in 1948 to arrange for passage as early as possible. Steamship companies have not issued sailing lists for 1948, but expect to do so in the early fall. A number of lines have listed sailings for the present season, among them, the Cunard, French, Belgian, Swedish, Norwegian, Gdynia (Polish), Holland-American, etc., the first mentioned expecting soon to have two new steamers in service. It is understood that the Thirteenth International Congress of Zoology will be held in Paris some time in July, 1948, and it is hoped that all entomologists going to Stockholm will plan to attend the Zoological Congress also in order that the interests of the entomologists may be fully represented before the more comprehensive body. Should a sufficient number of individuals indicate that they expect to sail about mid-June, it may be feasible to engage passage on the same steamer. Early information as to the probable number of participants is especially desired in order that the housing committee in Stockholm may make the necessary arrangements. The undersigned, as member of the executive committee, would appreciate it if he be kept informed as early as possible as to plans of those expecting to attend the sessions.—O. A. JOHANNSEN, Comstock Hall, C. U., Ithaca, N. Y. June, 1947.

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PSYCHE

VOL. 54 DECEMBER, 1947 No. 4

ON SOME JAPYGIDÆ IN THE MUSEUM OF COMPARATIVE ZOÖLOGY (DICELLURA)[1]

BY F. SILVESTRI
Laboratorio di Entomologia Agraria, Portici, Italy

During my last visit to Harvard University, at the Tercentenary Celebration (1936), I received a small collection of Japygidæ from the Museum of Comparative Zoölogy. Study of this material shows that the collection includes:

1) Specimens of *J. subterraneus* Packard, which I think worthy of redescription in order to fix the characters of this species, the first japygid described from the United States.
2) *Metajapyx confectus* sp. n. from Washington, District of Columbia.
3) *Evalljapyx sonoranus* Silv., which is redescribed after comparison with the type from Arizona.
4) *Evalljapyx dispar* sp. n., from Santa Cruz Island, California.
5) *Evalljapyx darlingtoni* sp. n., from Jamaica.
6) *Japygianus wheeleri* gen. n. et sp. n., from Queensland, Australia.

Metajapyx subterraneus (Pack.)

Text-fig. 1; plate 17, fig. 1.

Japyx subterraneus Packard, Amer. Natur., 8 (1874), p. 501, fig.; MacGillivray, Can. Ent. 25 (1893), p. 173; Packard, Amer. Natur. (1886), p. 382.

? *Japyx multidens* O. F. Cook, Proc. ent. soc. Washington 4 (1899), p. 225.

---

[1] Published with a grant from the Museum of Comparative Zoology at Harvard College.

♀ Corpus cremeum abdomine a segmento sexto gradatim ferrugineo, forcipis marginibus et apice nigrescentibus.

Caput supra setis c. 15 + 15 brevibus et parum longis (ad mm. 0.156) et seta nonnulla brevissima instructum; antennæ 32-articulatæ, articulo tertio subæque longo atque lato, setis majoribus ad mm. 0.185 longis, articulorum ceterorum setis et sensillis vide fig. 1 (1–2); maxillæ primi paris laminis pectinatis 5; palpus labialis mm. 0.065 longus, subconicus setis apicalibus quam palpus parum longioribus, submento macrochætis posticis eiusdem dimidia latitudo haud attingentibus.

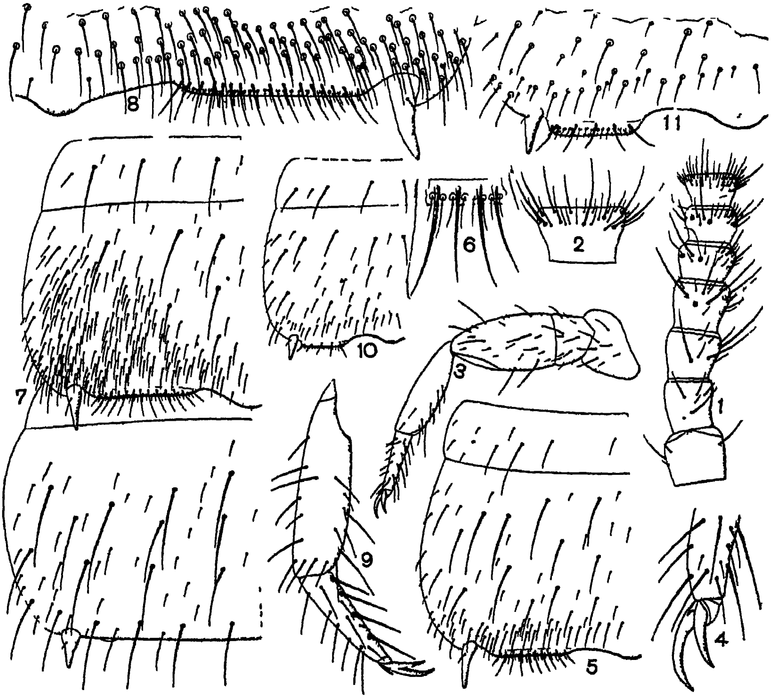
Thorax. Pronotum setis longis 5 + 5, quarum laterales aliquantum longiores (mm. 0.20 longæ) et seta nonnulla minima; meso- et meta-notum præscuto setis duabus submedianis brevibus et setis duabus brevissimis, scuto setis 7 + 7 longis et sat longis et nonnullis brevibus et brevioribus instructum; sterna setis nonnullis brevibus, brevioribus et brevissimis.

Pedes facie externa præsertim setosa, tibiæ seta infera apicali tarsi dimidiam longitudinem fere attingente, tarso quam prætarsus quadruplo longiore, infra seriebus duabus setarum 4, quam ceteræ robustioribus et aliquantum longioribus, prætarsi unguicula bene evoluta et ungue postico quam anticus aliquantum longiore.

Abdomen. Tergita 3^{um} ad 7^{um} setis duabus anticis submedianis brevibus, setis 5 + 5 sat longis, setis brevioribus nonnullis et setis brevissimis sat numerosis instructa; tergitum sextum quam quintum parum (parum minus quam $\frac{1}{3}$) latius angulo postico obtuso, sextum angulo postico vix acute producto, septimum angulo postico subacuto latiusculo retrorsum c. mm. 0.130, octavum quam septimum parum longius et fere $\frac{1}{4}$ angustius, angulo laterali postico vix producto.

Urosternum primum organis subcoxalibus quartam partem marginis posticis inter stilos subæquantibus, setis brevibus 14 uniseriatis et setis brevissimis glandularibus contiguis posticis uniseriatis instructis, organo glandulari mediano disculis 9 contiguis composito; urosterni superficie ante organa subcoxalia setis sat numerosis brevibus transverse irregulariter 2–3 dispositis, ante organum medium setis minimis 1 + 1, superficie cetera setis nonnullis sat longis transverse 4-seriatis et setis brevioribus sparsis parum numerosis; stilis et vesiculis consuetis.

Segmentum ultimum supra mensum subæque longum atque latium setis sat longis 5 + 5, seta nonnulla breviore et setis minimis sat numerosis, carinis sublateralibus subintegris, acropygio brevissimo, latiusculo, late rotundato.



Text-fig. 1. *Metajapyx subterraneus:* 1. antennæ dexteræ articuli 1us ad 7um super inspecti; 2. eiusdem antennæ articulus 10us magis ampliatus; 3. pes paris tertii (setis nonnullis punctis indicatis abruptis); 4. eiusdem pedis tarsi apex et prætarsus a facie antica inspecti; 5. feminæ urosternum 1um; 6 eiusdem urosterni organi subcoxalis particula multo ampliata; 7. maris urosterna 1um et 2um; 8. maris urosterni 1i pars postica magis ampliata; 9. larvæ 3æ ætatis pedis postici tibia, tarsus et prætarsus; 10. eiusdem larvæ urosternum 1um; 11. eiusdem urosterni pars postica magis ampliata (figg. varie ampliatæ).

Forceps segmenti decimi longitudinem dorsualem æquans, brachio dextero dente majore ad apicem tertiæ partis proximalis marginis interni sito, margine prædentali denticulis 4 uniseriatis, margine postdentali toto gradatim minus profunde crenulato, brachio lævo dente majore submediano, margine prædentali denticulis perparvis biseriatis 10/9, margine postdentali vix crenulato.

Long. corporis mm. 7; lat. urotergiti septimi 1.05, long. antennarum 2.50.

♂ Exemplum examinatum statura paullum majore (ad mm. 8, lat. urotergiti septimi 1.23) differt præsertim urosterno primo, quod organis subcoxalibus latioribus et urosterni superficie ante organa subcoxalia area subtriangulari, lato majore postico, fere ad præsternum externe extensa setis sat longis pernumerosis ut fig. 1 (7–8) demonstrat instructa; forcipis brachio dextero ante seriem prædentalem denticulorum 4 denticulo quinto parvo aucto.

Habitat. In the collection of the Museum of Comparative Zoölogy I have found 3 specimens with the label "*Japyx subterraneus,* Packard compared with type A.S.P." from S. Ohio, Nov. 1874; from these specimens I have selected the female and the male here described. In the same Museum I have seen a specimen also labeled *Japyx subterraneus* from Lee Co., Va. (July 1879 Hubbard). It agrees in the above characters with the specimens from Ohio.

Metajapyx confectus sp. n.

Text-fig. 2; plate 17, fig. 2

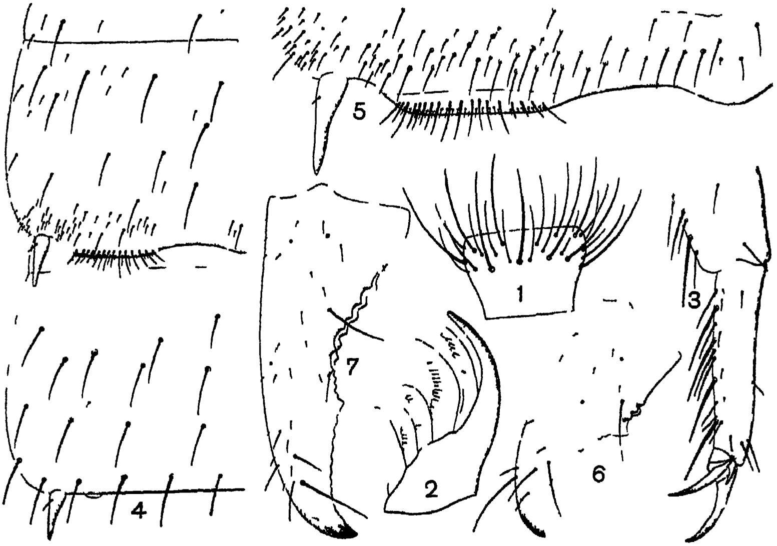
♀ Corpus ochroleucum ab abdominis segmento septimo ferrugineo-latericio, forcipis apice et marginibus nigris.

Caput supra setis sat longis (mm. 0.156) c. 15 + 15 et seta nonnulla breviore et setis brevissimis parum numerosis instructum; antennæ 32-articulatæ, articulo tertio setis majoribus mm. 0.24 longis, articulis ceteris etiam setis et sensillis speciei præcedentis similibus; maxillæ primi paris lobo interno laminis pectinatis 5 (prima inclusa).

Thorax. Pronotum setis 6 + 6, quarum longiores mm.

0.260 longæ sunt; meso- et metanotum setis sat longis 7–7 et nonnullis brevioribus et brevissimis (in exemplis asservatis fere omnibus abruptis); sterna setis paucis brevibus et brevioribus instructa.

Pedes setosuli, tibia quam tarsus fere $\frac{1}{3}$ longiore, seta apicali quam tarsus $\frac{3}{5}$ breviore, prætarsi ungue postico quam anticus $\frac{1}{4}$ longiore.



Text-fig. 2. *Metajapyx confectus:* 1. antennæ dexteræ articulus 16^{us} multo ampliatus; 2. maxilla primi paris lobus internus; 3. pedis postici tibiæ apex, tarsus et prætarus; 4. urosterna 1^{um} et 2^{um}; 5. eiusdem urosterni pars postica magis ampliata; 6. forcipis brachium dexterum supinum; 7. forcipis brachium lævum pronum (figg. vario ampliatæ).

Abdomen. Tergita 3–7 setis sat longis 5 + 5, setis duabus subanticis submedianis brevibus et seta nonnulla breviora instructa; tergitum sextum quam quintum vix latius, angulo postico retrorsum vix producto, tergitum septimum angulo postico acuto, retrorsum c. mm. 0.170 producto, tergitum octavum longitudine septimo subæquali, parum fere $\frac{1}{4}$ angustiore.

Urosternum primum organis subcoxalibus latitudine fere quartam partem marginis posticis inter stilos æquans setis brevibus c. 20 et setis brevissimis glandularibus posticis uniseriatis, organo glandulari mediano disculis c. 19, urosterni superficie ante organa subcoxalia setis brevibus numerosis transverse et irregulariter 3–4 seriatis dimidium versus gradatim minus numerosis, ante organum medianum setis duabus brevioribus submedianis et setis duabus ante dictas brevibus; urosterni superficie cetera setis nonnullis parum longis transverse 4-seriatis et setis paucis brevioribus et brevibus.

Segmentum ultimum supra mensum paullum longius quam latius, superficie supera setis satis sat longis $5+5$, carinis sublateralibus bene distinctis, acropygio latiusculo, brevissimo, late rotundato.

Forceps segmenti decimi latitudinem æquans, brachio dextero dente majore robusto acuto multo præmediano, tuberculis prædentalibus 4, quorum 1 superum et 3 infera sunt ($\frac{1}{3}$), margine postdentali paullum profunde crenulato, brachio lævo dente majore quam dexterus minore, aliquantum post-mediano, margine prædentali denticulis biseriatis 6/10, margine postdentali crenulato.

Long. corporis ad mm. 10; lat. segmenti septimi 1.20; long. antennarum 2.50.

Habitat. Exempla vidi 5 ad Washington, D. C., lecta.

Observatio. Species hæc a præcedente forcipis brachio dextero parte proximali (prædentali) tuberculo supero et tuberculis 3 inferis armato facile distinguenda est.

Evalljapyx sonoranus Silv.

Text-fig. 3; plate 18, fig. 1

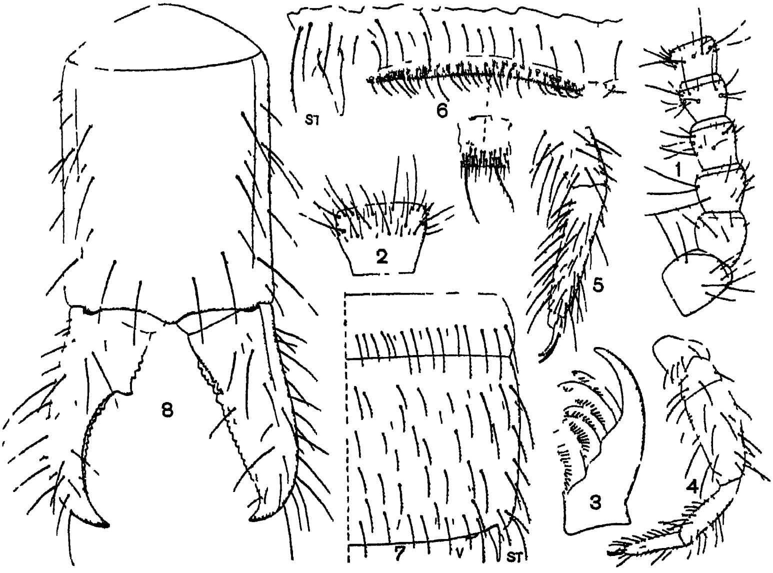
?*Japyx hubbardi* O. F. Cook, Proc. ent. soc. Washington 4 (1899), p. 225, Pl. I, fig. 2a–2b; Swenk, J. New York ent. soc. 11 (1903), p. 130.

Evalljapyx sonoranus Silv., Boll. Lab. Zool. Gen. Agr. Portici, 5 (1910), pp. 76, 77–78, fig. 4.

Corpus cremeum abdomine a segmento 6^{o} gradatim obscuriore, ferrugineo, forcipe badio lateribus et apice brunneis. Corporis setæ majores omnes parte distali breviter, unilateraliter plumatæ.

Caput supra setis c. $18+18$, mm. 0.20 longis, et setis magis numerosis sparsis brevioribus instructum; antennæ 30-articulatæ (articulis penultimo) et ultimo inter sese male distinctis, articulo 3^{o} parum ad apicem latiore quam longiore, seta dorsuali longiore mm. 0.28 longa, articulorum ceterorum setis et sensillis vide fig. 3 (1–2); maxillæ 1^{i} paris laminis pectinatis 5; palpus labialis mm. 0.10 longus.

Thorax. Pronotum setis 10 + 10 longiusculis (majoribus ad mm. 0.28) et setis paucis brevioribus instructum; meso- et metanotum præscuto setis longiusculis 1 + 1 vel 2 + 2 (in metanoto) et setis pronoti similibus et aliquantum magis numerosis; sterna setis longiusculis numerosis et nonnullis brevioribus instructa.



Text-fig. 3. ***Evalljapyx sonoranus:*** **1. antennæ lævæ articuli 1^{us} ad 6^{um} supra inspecti; 2. eiusdem antennæ articulus 14^{us} multo ampliatus; 3. maxilla 1^{i} paris lobus internus; 4. pes paris 3^{i}; 5. eiusdem pedis tibiæ apex, tarsus et prætarsus magis ampliati; 6. urosterni primi pars postica organo subcoxali retracto multo ampliata; 7. urosternum 3^{um}; 8. exempli alterius uritum decimum cum forcipe (figg. varie ampliatæ).**

Pedes setosuli, tarso quam tibia aliquantum breviore setis inferis biseriatis (8 + 8), seta dorsuali subapicali unguis externi dimidiam longitudinem parum superante, prætarsi unguibus parum arcuatis, ungue externo quam internus parum breviore.

Abdomen tergitis 1° ad 6^{um} setis longiusculis c. 18 + 18 præsertim sublateralibus et lateralibus et setis brevioribus et minimis sparsis, tergito 7° margine laterali late rotundato, margine postico quam mesotergiti angulis lateralis rotundatim vix producto paullum breviore et subrotundato, setis tergito sexto subsimili; tergito 8° parum latiore quam longiore, angulis posticis haud productis, superficie setis minimis numerosis et macrochætis 1 + 1 submedianis subanticis brevibus, submedianis subposticis 1 + 1 quam subanticæ parum longioribus et sublateralibus et lateralibus (utrimque 5) subæqualibus, tergito 9° brevissimo.

Urosternum primum organis subcoxalibus latis, urosterni partem medianam angustiorem haud occupantibus, setis pernumerosis minimis glandularibus 4–6 crebre seriatis et serie postica ventrali setis sensitivis brevibus c. 25–30 constituta, vix barbatis ad mm. 0.04 longis, superficie cetera per præsternum et coxosternum setis numerosis brevibus, breviter plumatis ut urosterna sequentia (Fig. 3) instructa nec non setis nonnullis brevissimis sparsis.

Segmentum ultimum, supra mensum fere $\frac{1}{4}$ longius quam latius, lateribus parallelis, superficie supera lineis duabus sublateralibus antice et postice abbreviatis, macrochætis c. 12 + 12 et setis minimis sparsis, acropygio brevissimo rotundato.

Forceps quam segmenti 10^{i} longitudo c. $\frac{1}{4}$ brevior brachiis robustis: dextero crasso, lato, parum longe ab apice tantum profunde sinuoso, apice arcuato acuto, dente destituto et pro dente sinu minimo affecto denticulis superis proximalibus 2, cetero margine inter basim et sinum apicalem toto denticulato, denticulis c. 20–25 uniseriatis; brachio lævo dente proximali magno acuto, denticulis prædentalibus 5 uniseriatis et postdentalibus uniseriatis, gradatim minoribus, c. 10.

Long. corporis ad mm. 12; lat. urotergiti 7^{i} 1.34; long. antennarum 2.20.

In exemplo alio femineo, statura vix minore, abdominis segmentum 10^{um} angustius est et forcipis brachium dexterum parum longiore margine interno postmediano minus lato, brachio lævo dentibus prædentalibus tantum 3.

Habitat. Exempla hic descripta super Montem Lemmon (Santa Catalina Montes), Arizona, inter 8000 et 9150 ft., July 26, 1917, lecta fuerunt; exemplum mm. 8 longum etiam vidi ad Oracle Springs, Arizona, March, lectum; exempla typica in agro ad Tucson, Arizona, legi.

Evalljapyx dispar Silv.

Text-fig. 4; plate 18, fig. 2

Syn. *Evalljapyx propinquus* Silv. partim (exemplum ex Monterey)

♀ Corpus ochroleucum ab urito 7° badio-ferrugineum forcipis marginibus parum obscurioribus; setis omnibus majoribus brevissima plumatis.

Caput setis longiusculis (ad mm. 0.20) c. 15 + 15 supra instructum; antennis 27-articulatis, articuli 3^{i} seta sublaterali supera ad mm. 0.20 longa.

Thorax. Pronotum setis 7 + 7 longiusculis, quarum sublateralis, transverse submediana, aliquantum longior (ad mm. 0.30 longa); meso- et metanotum præscuto setis duabus submedianis longiusculis, scuto setis longiusculis 10 + 10; sterna setis sat numerosis brevibus et brevioribus instructa.

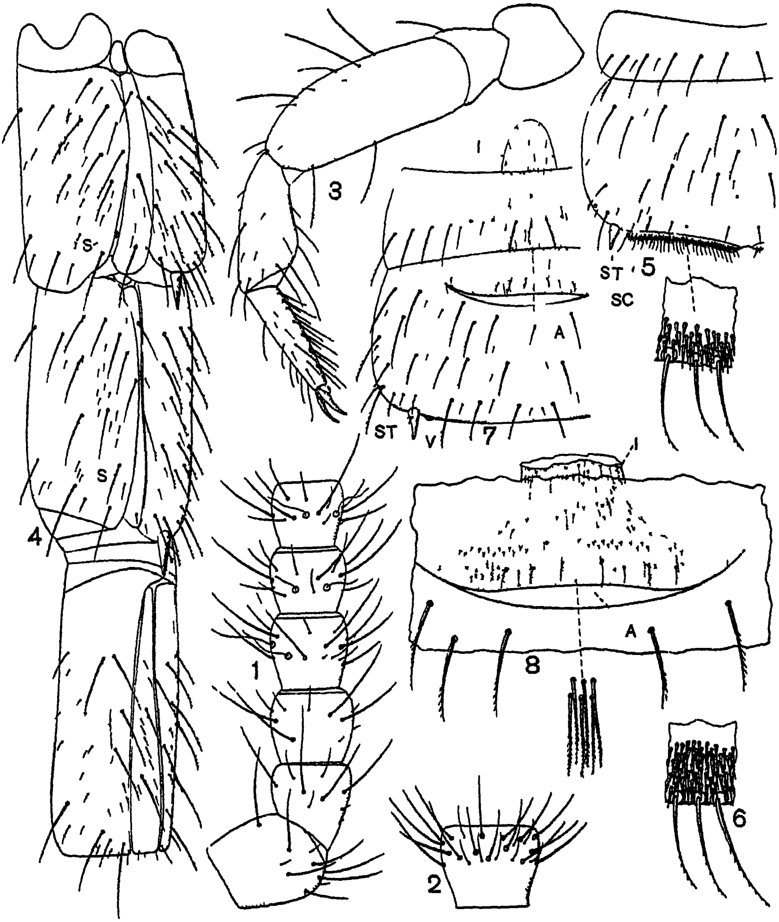
Pedes coxa, trocanthero et femore setis nonnullis longiusculis, tibia setis parum magis numerosis per dimidiam superficiem distalem, tarso setis ventralibus biseriatis c. 8 + 8, seta dorsuali subapicali ad dimidium unguem internum pertinente, ungue externo quam internus paullum breviore.

Abdomen. Tergitum 1^{um} præscuto setis duabus submedianis brevibus, scuto setis longiusculis 5 + 5, tergita 2^{um} ad 5^{um} angulis posticis rotundatis, setis longiusculis et brevibus c. 15 + 15 præsertim sublateralibus et lateralibus, tergita 6^{um} et 7^{um} angulo postico subrotundato.

Urosternum 1^{um} organis subcoxalibus latis fere totam partem posticam occupantibus setis sensitivis uniseriatis brevissime plumatis et setis glandularibus brevissimis inordinatim 3-seriatis instructis; superficie cetera setis sat numerosis brevibus ut urosterna 2^{um} ad 7^{um}.

Segmentum ultimum supra mensum parum longius quam latius, superficie setis longis et longiusculis c. 10 + 10, acropygio parvo rotundato.

Forceps quam segmenti decimi longitudo paullum longior, vel vix brevior, brachio dextero parte distali tantum attenuata bene arcuata, cetero marginibus subparal-



Text-fig. 4. *Evalljapyx dispai*: antennæ lævæ articuli 1^{us} ad 6^{um}; 2. ejusdem antennæ articulus 12^{us} magis ampliatus; 3. pes paris 3^{i}; 4. abdominis segmenta 6^{um} ad 8^{um} lateraliter inspecta; S stigmata; 5. feminæ urosternum 1^{um}, SC organum subcoxale, ST stilus; 6. maris urosterni 1^{i} organi subcoxalis perticula; 7. maris urosternum 3^{um}; 8. maris urosterni 3^{i} cum infundibulo subantico: A infundibili apertura externa (figg. varie ampliatæ).

lelis, tuberculis perparvis 2–4 proximalibus superis margine cetero denticulis perparvis in exemplo nonnullo per marginem intermedium subevanidis c. 20, sinus distalis margine etiam denticulis perparvis 8–10, brachio lævo dente proximali sat magno, tuberculis prædentalibus uniseriatis 3, brachio cetero gradatim attenuato, arcuato, apice acuto, latere interno bimarginato margine supero tuberculis convexis minimis 6–8, margine infero tuberculis parvis, gradatim minoribus c. 18–20.

Long. corporis ad mm. 9; lat. urotergiti 7ⁱ 1.10; long. antennarum 2.20. Mas. Urotergitum 7^{um} quam feminæ parum latius angulo postico retrorsum acute-rotundatim producto.

Urosternum 1^{um} quam feminæ setis glandularibus magis numerosis, inordinatim 5–7 seriatis.

Urosternum 3^{um} infundibuli subantici operculo lato, sacculo cuculliformi setis pernumerosis brevioribus plumatis instructo, longo (ad mm. 0.40).

Habitat. Exempla typica in Santa Cruz Insula (California meridionalis), La Playa Canyon, April 1915, lecta vidi et exemplum, a me ad Monterey, Calif., lectum et ut paratipum in 1910 ad *Ev. propinquus* relatum.

Observatio. Subspecies hæc ab *E. propinquus* Silv. antennis 27-articulatis et forcipis brachii dexteri sinu distali forma saltem distinguenda est.

Evalljapyx darlingtoni sp. n.

Text-fig. 5; plate 19, fig. 1

♀ Corpus ochroleucum abdomine segmento sexto partim ferrugineo et a segmento septimo latericio forcipis marginibus nigrescentibus. Corporis setæ dorsuales et ventrales præter minores plurisque ramulo distali auctæ sunt.

Caput supra setis 16 + 16 mm. 0.156 longis, setis nonnullis brevioribus et brevissimis sat numerosis instructum; antennæ 25-articulatæ, articulo tertio subæque longo atque lato, setis majoribus mm. 0.156 longis, setis ceteris huius et articulorum ceterorum vide fig. 5 (1–2) maxillæ primi paris lobus internus laminis 5, quarum prima falciformi angusta attenuata, integra, ceteræ pectinatæ; palpus labialus tuberculiformis, setis duabus longis et seta intermedia aliquantum breviore auctus.

Thorax. Pronotum setis sat longis (mm. 0.24) 6 + 6, setis brevibus et brevioribus nonnullis instructum; meso- et metanotum præscuto setis submedianis sat longis 1 + 1 et 1–2 + 1–2 brevissimis, scuto setis 9 + 9 sat longis, setis 4 + 4 brevibus et nonnullis brevioribus; sterna setis longiusculis, brevibus consuetis et nonnullis brevioribus sparsis instructa.

Pedes setis nonnullis longiusculis per tibiæ partem distalem magis numerosis et per tarsum; hoc setis ventralibus 8 biseriatis, seta dorsuali subapicali brevi; prætarsi unguibus parum arcuatis, subæqualibus unguicula consueta.

Abdomen. Tergitum primum præscuto setis duabus submedianis brevibus et nonnullis brevissimis, scuto setis parum longis 5 + 5 et seta nonnulla breviore et brevissima; tergitum secundum setis sat longis 8 + 8, tergita 3–6 setis sat longis 10 + 10, setis duabus subanticis submedianis brevibus et setis paucis brevioribus et brevissimis instructa, tergitum sextum angulo postico obtuso, septimum octavo longitudine subæquale et quam idem parum latiore, angulo postico, subrecto haud producto, octavum margine laterali postico haud producto.

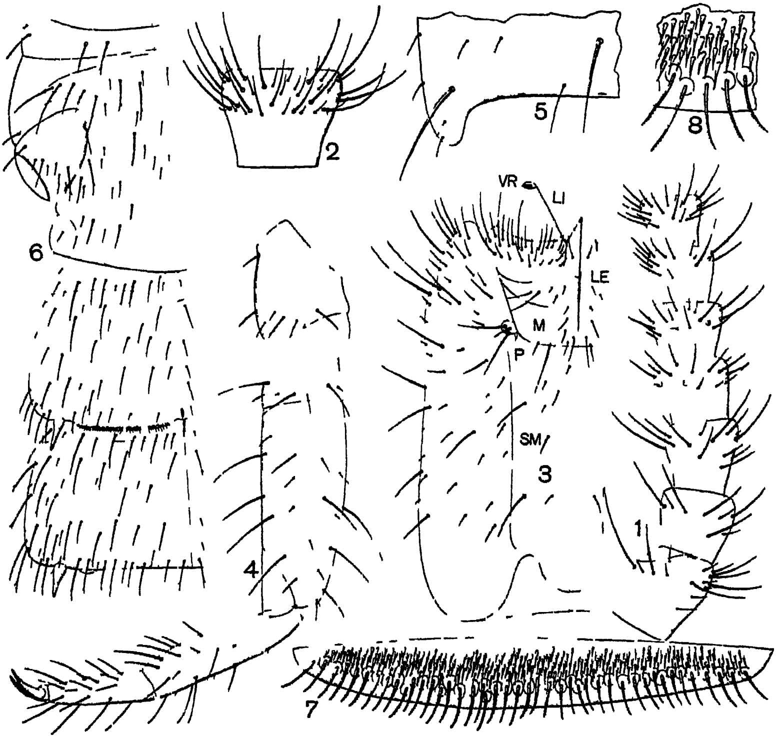
Urosternum primum organis subcoxalibus perlatis fere usque dimidium urosterni marginem attingentibus, setis glandularibus brevissimis pernumerosis 3–6 transverse inordinatim seriatis et setis sensitivis uniseriatis, fasi circulari sese tangentibus, brevibus, unilateraliter brevissime plumatis compositis, superficie cetera ut urosterna 2^{um} ad 7^{um} setis numerosis inordinatim transverse 5-seriatis et setis sparsis brevissimis aucta.

Segmentum decimum supra inspectum $\frac{1}{6}$ longius quam latius, carinis sublateralibus manifestis, parvis, setis longiusculis sublateralibus et lateralibus 8 + 8 et setis brevissimis sparsis instructum.

Forceps quam segmentum 10^{um} c. $\frac{1}{5}$ brevius, brachio dextero dentibus tuberculiformibus basalibus biseriatis: superis 5 perparvis, subtus 5 paullum majoribus, cetero margine usque sinum præapicalem denticulis 10, sinu præapicali denticulis 5 gradatim minoribus, brachio levo tuberculis prædentalibus 4, dente premediano sat magno, cetero margine sinu late arcuato denticulis biseriatis parvis: 7 superis et 9 inferis.

Long. corporis mm. 10; lat. urotergiti 7^1 1.10; long. antennarum 2.30.

Habitat. Exemplum typicum descriptum, clar. Dr.



Text-fig. 5. ***Evalljapyx darlingtoni:*** 1. antennæ lævæ articuli 1^{us} ad 7^{um}; 2. eiusdem antennæ articulus 10^{us} magis ampliatus; 3. caput subtus inspectum: T infundibulum subanticum, LE labii lobus externus, LO eiusdem lobus internus, M mentum, P. palpus labialis, SM submentum, VR vesicula retractilis; 4 pes paris 3^1; 5. urotergiti 7^1 angulus posticus; 6. metasternum cum urosternis 1^o et 2^o; urosterni 1^1 organus subcoxalis; 8. eiusdem particula magis ampliata (figg. varie ampliatæ).

Darlington, cui species dicata est, in Main Range, Blue Mts., 5–7000 ft., Jamaica, Aug. 17–19, 1934, legit.

Observatio. Species hæc ad *Ev. cubanus* Silv. proxima est, sed antennis 25-articulatis et forcipis forma facile distinguenda est.

Gen. **Japygianus** nov.

Genus a genere *Catajapyx* Silv. forcipis brachiis subæqualibus, quam segmentum decimum parum magis quam ¼ brevioribus, crassioribus, dentibus uniseriatis numerosis, nonnullo magnitudine parum diverso, distinctum est. Species typica: *Japygianus wheeleri* sp. n.

Japygianus wheeleri sp. n.

Text-fig. 6; plate 19, fig. 2

♂ Corpus ochraceum abdomine segmento sexto parum obscuriore, a segmento septimo ferrugineo-latericio, forcipis marginibus nigrescentibus.

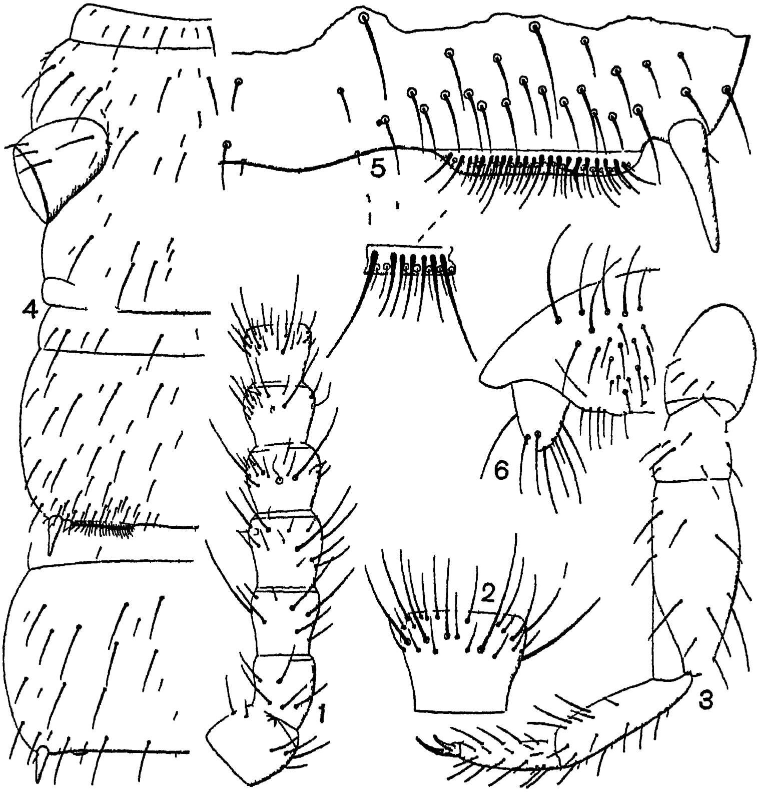
Caput supra setis brevibus (ad mm. 0.13) c. 18 + 18 et setis nonnullis brevioribus et brevissimis instructum; antennæ 30-articulatæ, articulo tertio subæque longo atque lato, setis majoribus mm. 0.19 longis, articulorum ceterorum etiam setis et trichobotriis consuetis vide fig. 6 (1–2); maxillæ primi paris lobo interno laminis pectinatis 5, palpo labialis mm. 0.11 longo subconico setis 6 brevibus et nonnulla breviore instructo.

Thorax. Pronotum setis sat longis (mm. 0.22) 5 + 5 et seta nonnulla breviore et brevissima instructum; meso- et metanotum præscuto setis duabus submedianis brevibus, scuto setis 6 + 6 sat longis et nonnulla breviore; sterna setis parum longis et nonnullis brevioribus ut fig. 6, demonstrat.

Pedes setis longiusculis nonnullis præsertim per tibiæ partem distalem, tarso setis numerosis brevibus, quarum inferæ, biseriatæ a 1^{a} ad 4^{am} gradatim longioribus, seta dorsuali subapicali ut laterales brevi, prætarsi ungue postico quam anticus aliquantum longiore, unguibus parum arcuatis robustis, unguicula bene distincta.

Abdomen. Tergitum primum præscuto setis duabus submedianis brevibus et scuto setis duabus submedianis subposticis parum longis et setis nonnullis brevissimis, tergitum secundum scuto setis 4 + 4 parum longis et setis duabus subanticis submedianis brevibus, tergita 3–7 setis parum longis 6 + 6 et setis subanticis submedianis duabus brevibus instructa, tergitum sextum quinto latitudine subæquali angulo postico obtuso, septimum quam quintum haud latius, angulis posticis angustioribus, acutis, corniformibus, retrorsum mm. 0.14 productis, octavum quam septimum c. $\frac{1}{6}$ angustius et parum brevius margine laterali postico acute aliquantum producto.

Urosternum primum organis subcoxalibus parum magis



Text fig 6 *Japygianus wheeleri* 1 antennæ lævæ articuli 1us ad 6um supra inspecti, 2 eiusdem antennæ articulus 10us magis ampliatus, 3 pes paris 3i, 4 metasternum cum urosternitis 1° et 2°, 5 urosterni 1i paris postica multo ampliati, 6 maris dimidia pars genitalis externa (figg varie ampliatæ)

quam marginis inter stilos quartam partem occupantibus setis brevibus glandularibus c. 22, quarum 5 quam ceteræ parum longiores et setis sensitivis cum glandularibus alternatis et quam eadem brevioribus, superficie cetera ut urosterna 2um ad 7um setis brevibus c. 16 + 16 et nonnullis brevissimis sparsis; vesiculis perparvis, stilis brevibus.

Segmentum decimum supra mensum c. 1/10 longius quam latius, superficie supera et laterali setis longis vel sat longis 9 + 9 carinis nullis, acropygio brevi, subtriangulari.

Forceps quam segmenti decimi latitudo c. ¼ brevius, brachiis robustis, brachio dextero dentibus 16, quorum quartus et sextus quam proximales paullum et nonus quam ceteri parum major est, posticis gradatim minoribus, brachio lævo etiam dentibus 16, quorum quartus, sextus et duodecimus quam ceteri parum majores sunt.

Appendices genitales breviores, subconicæ, setis parum longis 8 instructæ.

Long. corporis mm. 8; lat. urotergiti septimi 1; long. antennarum 2.4.

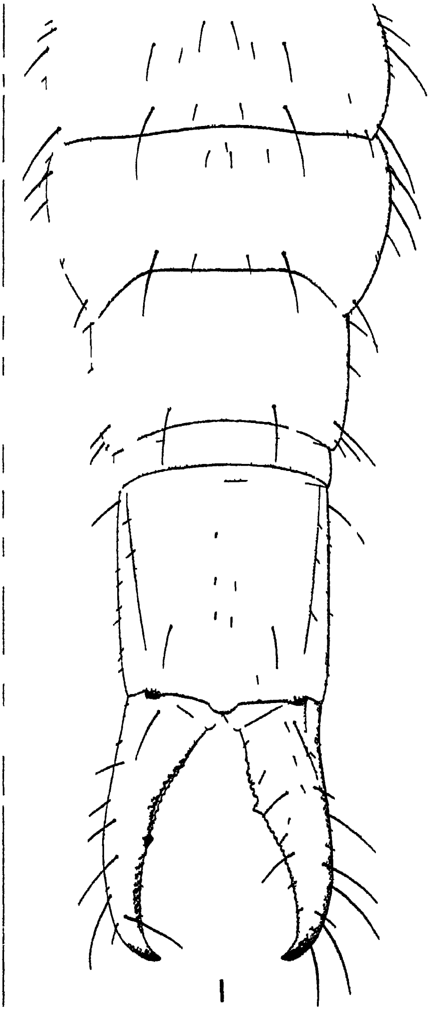
Habitat. Exemplum typicum descriptum ad Kuranda (Queensland), Oct. 21, Dr. W. M. Wheeler, cui speciem in memoriam dico, legit.

EXPLANATION OF PLATE 17

Fig. 1. *Metajapyx subterraneus:* abdominis pars postica a segmento 6° prona (fig. ampliata).

Fig. 2. *Metajapyx confectus:* abdominis pars postica a segmento 6° prona (fig. ampliata).

Psyche 1947 Vol. 54 Plate 17



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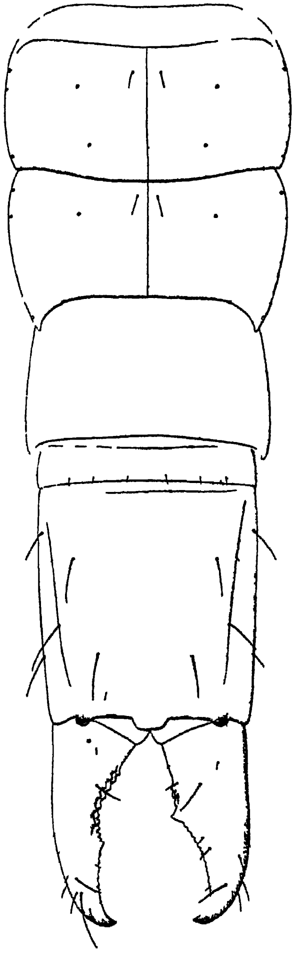

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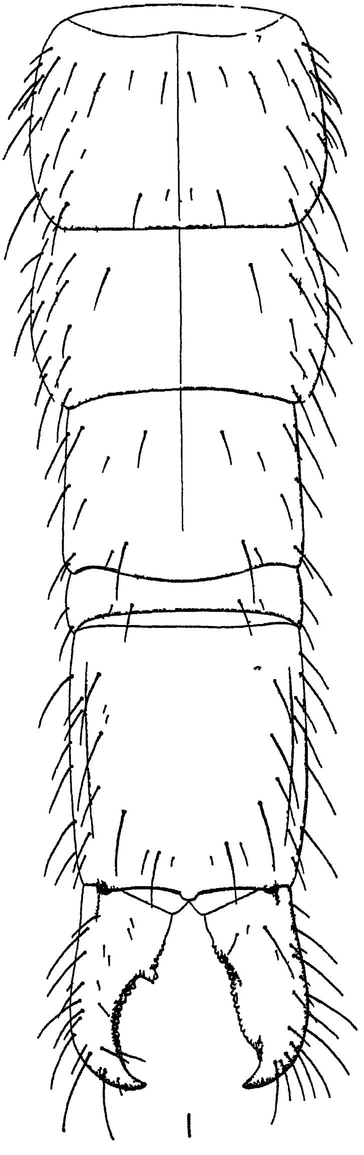
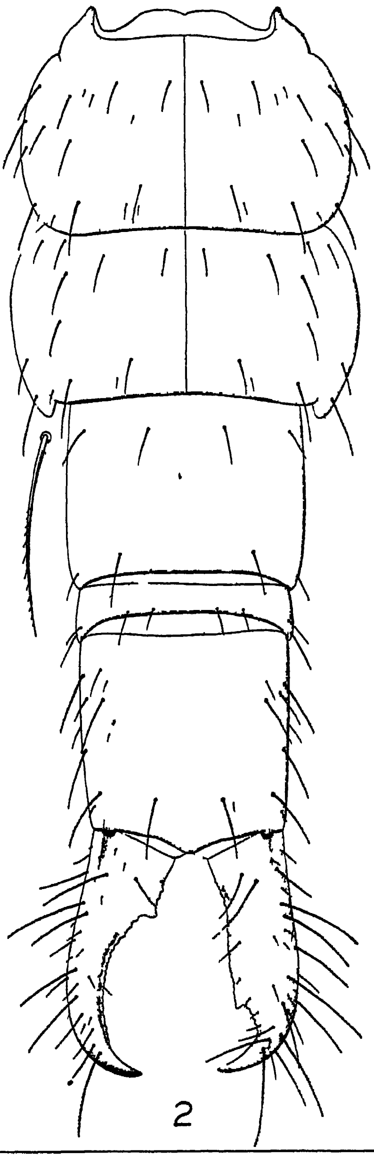
Silvestri—Japygidae

EXPLANATION OF PLATE 18

Fig. 1. ***Evalljapyx sonoranus:*** abdominis pars postica a segmento 6° prona (fig. ampliata).

Fig. 2. ***Evalljapyx dispar:*** abdominis pars postica a segmento 6° prona (fig. ampliata).





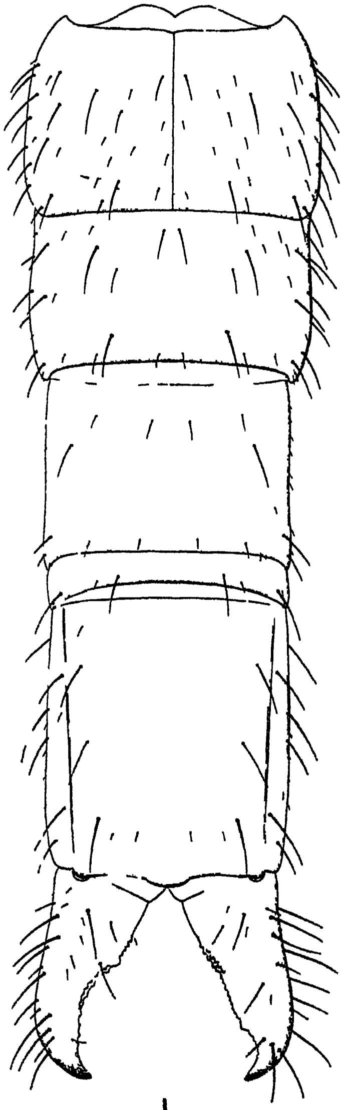
Silvestri—Japygidae

EXPLANATION OF PLATE 19

Fig. 1. *Evalljapyx darlingtoni:* abdominis pars postica a segmento 6° prona (fig. ampliata).

Fig. 2. *Japygianus wheeleri:* abdominis pars postica a segmenta 6° prona (fig. ampliata).

PSYCHE, 1947 VOL 54, PLATE 19



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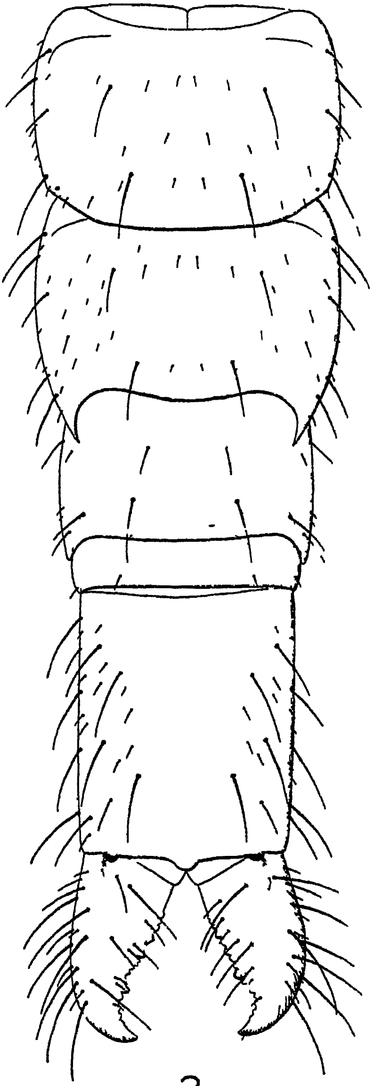

2

SILVESTRI—JAPYGIDÆ

SOME AMERICAN SYRPHID FLIES

By Frank M. Hull
University of Mississippi

Recent collections of flies submitted to the author contain a number of neotropical species of *Baccha* which are undescribed. This paper gives the descriptions of these flies. A species of *Rhinoprosopa* is included.

Baccha balboa n. sp.

A petiolate species, the face without tubercle, the anterior margin of the wing narrowly brown. Related to *bigoti* Austen but without the reddish spots on the fourth segment and with different pattern upon the wing. Length 10 mm.

Male. *Head:* the vertex is polished black, rather flat, the long black pile lies in a single row. The front is black, with faint bluish reflections and protuberant just in front of the narrow antennal callus; the sides of the front are diffusely yellowish grey pollinose; the frontal pile is long and fine and black. The face is black with faint bluish reflections, nearly straight in profile but retreating and without tubercle; the sides are widely yellowish grey pubescent with similarly colored pile. The antennæ are dark brown, the third segment and apex of the second segment reddish below; arista dark brown. The occiput is yellowish grey pollinose with fine, white, non-scalose pile which becomes blackish near the vertex. The posterior eye margin is not indented in the middle but the eye is developed above so that the occiput can not be seen laterally on the upper third. *Thorax:* the mesonotum is polished shining including the scutellum; the humeri and the post calli are shining, dark sepia brown; there are no vittæ present and no pollen. The mesonotal pile is fine, erect, fairly long and blackish without anterior collar, the pile becoming shorter and pale yellow in front of the scutellum. The scutellar pile is fine and long and yellow; the ventral fringe consists of fifteen or more pairs of long, pale yellow hairs; the pleura are black and somewhat brassy down the middle, their pile thick, long and pale yellow. The squamæ are white, the fringe and border pale yellow, the halteres dark brown. *Abdomen:* slender and petiolate, first segment wholly shining greenish black with long, abundant, fine yellow pile on the sides. The second segment is light brownish red, shining and with a slender, medial, brownish black line running almost the full length of the segment stopping close to the base; this segment is nine times as long as its least width; the width at the apex is a little more than one and one-half times as long as the least width, the basal width barely greater than the apical width. The third segment has a pair of large, pale, brownish red, elongate, posteromedially produced spots upon the base of the segment which are separated by light brown in the middle; the remainder of the segment except the posterior border is nearly opaque black, the posterior margin shining. The fourth and fifth segments are wholly shining black; the fourth segment is not quite twice as long as wide. The sides of the second segment have long, fine, abundant pile directed outwardly; there is similar but shorter pile on the sides of the third segment except the posterior fifth where it is appressed; there is still shorter erect pile on the sides of the basal half of the fourth segment; the erect pile on the third and fourth segments is reddish yellow but on the second segment it is chiefly blackish except at the immediate base. All other pile of the abdomen is black. *Legs:* the anterior and middle femora are light reddish brown; their tibiæ are pale brown becoming a little more yellowish close to the apices and the base. The anterior tarsi are brown, the middle tarsi entirely yellow. The hind femur is sepia except at the extreme apex; hind tibiæ black, the base narrowly yellowish, its pile black. The hind basitarsi are black on the basal half with sepia pile, diffusely shading in the middle to pale yellow; the remaining segments are pale yellow. The pile of the hind femur is sepia to black. *Wings:* pale brownish hyaline; the pterostigma and the anterior margin of the wing to the end of the submarginal cell is dark brown. The dark brown margin extends back along the submarginal cell a distance basally beyond the end of the subapical cross vein equal to the petiole of the first posterior cell. The marginal cell except at the apex of the wing, the costal cell and a large diffuse spot in the middle of the wing are more yellowish or reddish brown. The central wing spot extends only narrowly beyond the anterior cross vein, which cross vein lies close to the base of the discal cell, and borders the cubital cross vein. The whole subcostal cell is dark brown; alulæ quite wide.

Female. Similar to the male, the sides of the front greyish white pollinose; the ground color of the front is strongly shining bluish black but in the middle it appears to be more purplish black; the occipital pile is confined to a single, neatly formed row of long, pale yellow hairs which become reddish brown above and nearly whitish close to the oral margin where there are several rows of hairs. Notopleural bullus rather conspicuous, the posterior part of the notopleura whitish pollinose. The mesonotal pile is a little shorter than in the male, the pleura have an obscure brownish red stripe down the middle; the pteropleura are wholly metallic black; the halteres have a yellowish brown to reddish knob. Upon the abdomen the medial dark brown stripe of the second segment appears to be wanting and the basal spots of the third segment smaller and more diffuse.

Holotype: a male, La Suiza, Costa Rica, 24; Pablo Schild; allotype: a female with the same data without numeral; there is also a paratype male and female with the same locality and collector. Type and allotype in the collection of Dr. A. L. Melander.

Baccha zephyrea n. sp.

A slender species related to *argentina* Curran, but with different pattern. Length 8 mm.

Male. *Head:* the vertex is quite protuberant, black, the black pile in a single row; the bluish black front is prominently transversely striate and abundantly long black pilose on the sides but rather bare in the middle and the sides of the front are linearly yellowish white pollinose; the lunate antennal callus is yellowish brown, blackish in the middle. The face is metallic blackish on the upper half becoming light yellowish brown on the tubercle and the cheeks; the middle of the cheeks with a brownish spot. The antennæ are yellowish brown. *Thorax:* the mesonotum is strongly brassy black, coppery just in front of the postcalli; the lateral margins and the notopleura appear to be yellowish brown in ground color but so dark as well as metallic in reflections that they do not contrast greatly with the disc of the mesonotum. The mesonotum has a pair of short, obscure, brownish red pollinose vittæ and some sparse, similar pollen in front of the scutellum. The mesonotal pile is sparse, short and apparently light in color; pleura metallic black, only the posterior part of the mesopleura and the anterior part of the pteropleura are obscure yellowish brown; the squamæ are light yellow, the stalk of halteres pale yellow with reddish brown knob. *Abdomen:* very slender and petiolate, the first segment black, its protuberant lateral margins light brownish yellow. The spots of the abdomen are sharp and distinct but are for the most part pale brownish orange. On the sides of the base of the second segment there is a quite long spot of light color, occupying about a third of the length of the segment sharply and distinctly separated by black in the middle; beginning just before the middle of the segment there is a long, complete pale band occupying a little more than one-fourth the length of the segment; remainder of this segment shining black. The second segment is fifteen times as long as its least width and not quite twice as wide at apex and just twice as wide as its base. The third segment has two long, complete bands of light color, one on the base, one beginning just before the middle of the segment, divided by a narrow brown line; the fifth segment is wholly black; the hypopygium is prominent. The pile along the second segment is very sparse and short. *Legs:* the anterior legs are entirely brownish yellow, the middle legs missing. The posterior femora and tibiæ are very pale yellowish brown, their tarsi almost as light; the dorsal surface of these tarsi is pale brown with brown pile; the pile of the hind tibiæ is quite sparse, quite short and dark in color. *Wings:* not quite hyaline; the pterostigma is yellowish brown, the costal and basal cell slightly paler than the remainder of the wing; there is no alula, not even a trace.

Holotype: a male, Villarica, Paraguay, August, 1938; F. Schade collector. In the collection of Dr. A. L. Melander.

Baccha ursula n. sp.

A dark, sepia brown species with sepia brown wings. Related to *danaida* Hull but with differently shaped spots on the abdomen. Length 11.5 mm.

Male. *Head:* the vertex is dully shining black, considerably raised, its pile black and situated in a single row. The lateral margin of the eye is considerably incised on the posterior surface; the occipital pile is fine and yellowish white. The front is black, moderately shining, faintly brassy in some lights with the lateral margins narrowly but diffusely yellowish. In an oblique light the middle of the front is very dark brown pollinose; the preantennal callus is shining black in the middle and narrowly yellow above each antennæ. The face has a reddish brown tubercle; the sides of the face and the area below it are light brownish yellow; the middle of the face above the tubercle is diffusely brownish black with little angular spots which are slightly more widely separated and lie slightly before the middle of the segment. Fourth segment with a pair of similar though slightly more obscure, or diffuse and vittate, or longitudinal, oval spots which also lie just before the middle of the segment. Fifth segment without spots. The middles of the second, third and fourth segments are only sub-opaque when viewed obliquely. *Legs:* the anterior and middle femora are yellowish or reddish brown becoming slightly darker towards the base, their tibiæ and tarsi are entirely pale brownish orange. The hind femora are light reddish sepia, their tibiæ similar but a little darker in the middle and the pile of the tibiæ more nearly blackish in the middle. The base of the hind basitarsi is brown with sepia brown pile, the remainder of these tarsi light brownish yellow with golden pile. *Wings:* dark sepia brown throughout, the pterostigma and the basal portion of the marginal cell a little bit darker. Alulæ well-developed, long and narrow.

Female. Similar to the male, the vertex, however, is not especially raised; the sides of the front are also diffusely brownish yellow, the middle dark brown pollinose; the first two segments of the antennæ are reddish brown in color, rather darker than in the male. *Thorax:* the mesonotum is bright coppery violaceous in color, the widely separated yellowish brown vittæ are somewhat more narrow, the lateral margin a little more yellowish; the light colored areas of the pleura are more yellowish and extend across the pteropleura and include much of the metapleura. The squamæ are distinctly yellowish brown. The scutellum is lighter in color than in the male, is brownish yellow especially around the margins and the base; its pile is also sparse but is shorter; there is no ventral fringe. *Abdomen:* much wider and even more flattened than in the male; the sides of the fifth and sixth segments are somewhat emarginate; the second segment is almost rectangular, but is a little wider at the apex than at the base. The fourth segment has parallel sides. The apical portion of the abdomen is considerably wider than in the male; the second segment is also wider; the spots upon the second segment are linear, upon the third segment they are very short oval or subcircular but irregular and diffuse; on the fourth segment the spots are linear, smaller and much more obscure; on the fifth segment there is a trace of linear, yellowish brown spots. Legs similar to the male; the wings are similar to the male, quite dark, the whole marginal and submarginal cells slightly darker than the posterior part of the wings; there is a faint streak of light color in the costal cell and along the base of the vena spuria. These streaks may be abberant.

Holotype: a male, Villa Rica, Paraguay, September 1938; F. Schade; allotype: a female, same locality, February 1940; F. Schade. There are two paratype males, Feb. 1940 and Feb. 1941 from the same locality. Holotype and allotype in the collection of Dr. A. L. Melander.

Baccha cybele n. sp.

A black species, the wings sepia brown with only the apical fourth hyaline. Second, third and fourth segments of the hind tarsi white. Related to *clarapex* Wiedemann. Length 9.5 mm.

Male. *Head:* the vertex is bluish black and shining, moderately raised, the black pile lies in a single row; the posterior lateral eye margins are deeply incised in the middle; there is a long row of silvery occipital pile behind, fine and non-scalose, long in the middle becoming blackish towards the top of the occiput; along the indented area of the eye there is a double row of long fine black hairs which are replaced by white ones on the lower part of the occiput. The occipital pollen is greyish white but the black hairs arise from minute black punctate spots. Front black, faintly bluish and in some lights with an azure blue reflection. The upper third of the front is opaque black bordered by brown pollen and in turn the brown pollen bordered with a spot of silvery pollen which lies on the upper eye margin and is visible only from above. The antennal callus is large, shining brownish black, narrowly and diffusely brownish yellow along the sides in the middle of the face only. The cheeks are metallic black; the sides of the face are widely white pubescent or pollinose; the tubercle is rather sharp, gently sloping above, somewhat more abruptly below. The antennæ are dark brown, reddish brown below at the base of the third segment. The arista is dark brown but lighter at the immediate base. The frontal pile and nearly all of the basal is black. *Thorax:* the mesonotum is black, moderately shining with a pair of very obscure, reddish brown pollinose spots on either side of the middle of the anterior margin; the entire anterior margin is more narrowly but similarly pollinose. There is a still more obscure, narrow, greyish streak down each side of the mesonotum reaching nearly to the transverse suture. The pleura are wholly metallic black, thinly whitish pollinose and with long sparse yellowish white pile. The scutellum is black with only a few, long, fine black hairs; the ventral fringe consists of seven or eight pairs of moderately long black hairs. There is an anterior mesonotal collar of pale yellow hairs. The squamæ are light brown, the halteres pale brown with reddish knob. *Abdomen:* petiolate, shining black, the first segment with slight bluish reflections, its sides with thick long yellowish white pile and some black hairs both dorsally and anteriorly. The second segment is a little bluish along the sides and narrowly along the apical margin. There is a prominent, subapical, opaque black annulus which is prolonged and produced forward in the middle to within a short distance of the base. The second segment is slightly over three times as long as its least width. The third segment is considerably wider, especially at the apex and with a pair of obscure, opaque black triangles on either side and medial opaque stripe. The fourth segment is similar, the opaque areas less distinct. On both the third and fourth segments the opaque areas are only visible from an oblique posterior or anterior view. The fifth segment is wholly shining black; the pile of the abdomen is black beyond the first segment except for a very few white hairs on the sides of the second segment near the base. *Legs:* the anterior and middle femora and tibiæ are brownish black; their apices and bases of the tibiæ are narrowly reddish brown. The anterior and middle tarsi are dark brown; the hind femora, except the narrow base and apex and the hind tibiæ except the extreme base, are black, both with black pile. The basal three-fourths of the hind basitarsi are black and black pilose; remainder of these tarsi with nearly similarly colored pile. *Wings:* sepia brown throughout except upon the apical fifth; the brown color fills the discal cell. The alulæ are wide and well-developed; there is an abnormality in the second longitudinal vein near the end of the marginal cell in both wings; it consists of a spur directed obliquely outward cutting half way across the submarginal cell.

Holotype: a male, Villa Rica, Paraguay, Nov. 1938 collected by F. Schade; one paratype male, Dec. 1936 but otherwise the same data. Type in the collection of Dr. A. L. Melander; paratype in the author's collection.

Baccha duida n. sp.

A quite slender fly with dilute, light brown wings and without alulæ. The third vein is deeply drawn down posteriorly as it reaches the wing apex. Length 9.10 mm.

Male. *Head:* face and front light brownish yellow but medium brown in the center of the front which merges into a blackish, medial, elongate spot just above the antennæ. The antennæ are short, the third segment thickened and rounded and light brown; the basal segments are darker, their pile black. The front and facial pile is black, the face narrow, the creases deep, the face barely more narrow ventrally. The vertex is raised and rather shining black, its black pile is situated in a single row; the posterior part of the vertex is brownish pollinose. The upper occipital pile is reddish golden and brassy on the sides. *Thorax:* mesonotum shining black with three slender, reddish-brown pollinose vittæ; the outer one may possibly be divided into two posteriorly. The humeri, the lateral margins, the post calli and all of the scutellum, all the pleura except the posterior part of the metapleura, the lower part of the sternopleura and the anterior part of the mesopleura, are all light reddish brown; the remainder of the pleura are dark brown and the disc of the scutellum viewed from the side appears dark brown. The mesonotal pile is sparse, fine, erect and brown. The ventral scutellar fringe consists of six or seven short black hairs. *Abdomen:* quite slender and dark brown becoming black on the posterior portion of the segments; the second segment has a pair of narrowly separated, elongate, orange brown spots beginning just past the middle and margined dorsally with opaque black and extending down the lateral margins; laterally these spots show a slight posterior indentation. The third segment has a similar pair of spots in the middle, longer, anteriorly attenuated and with V-shaped notch posteriorly. The fourth segment has a similar pair of spots of about the same size. The spots on both the third and fourth segments show some indication of running narrowly and obscurely to the base of the segment; the basolateral areas of the segments are, however, shining brownish black; fifth segment shining black. The pile along the sides of the second abdominal segment is very sparse and short but a little longer on the posterior half; the pile on the sides of the first segment is sparse and moderately long in the corners and brownish black. *Legs:* anterior pair light brownish yellow with pale pile; medial pair light brown, the lateral fringe of the middle femora moderately long and reddish brown. The hind femora are pale reddish brown with wide, obscure, darker brown subapical bands. The hind tibiæ are slender, preapically compressed, straight and reddish brown with, in the middle, a brownish yellow band. The hind basitarsi are slender and entirely brown with dark brown pile on the dorsal surface and brownish yellow pile below; last segments missing. The pile of the hind tibiæ and femora is brownish black. *Wings:* slender, and light brown including the costal cell; stigmal cell dark brown, lighter below the costal cell; the third vein is arched and considerably drawn down apically; alulæ quite absent; anal lobe almost hyaline.

Holotype: a male, Mt. Duida, Venezuela, Dec. 1, 1928. Accession 25500, 423; Tate. In the American Museum of Natural History.

Rhinoprosopa sycorax n. sp.

A yellow and brown species with pale yellowish wings. Related to *lucifer* Hull. Length about 9 mm.

Female. *Head:* the vertex is brassy black, the ocelli set off by a crease touching their margins; the vertical pile is short and black. The front is brownish black in the middle with the sides ochraceous yellow and in the midline there is a brassy, linear stripe wider on the upper half; the face is reddish sepia in the middle with a very low pinched tubercle; the sides of the face and cheeks are light yellow. The face is triangularly produced forward as is characteristic of the genus but not as much as in *ænea* Hull. The antennæ are slightly elongate and reddish orange; the dorsal surface of the third segment is blackish, the arista black. The pile of the front is fine and sparse and black; the sparse facial pile is whitish; the pile of the occiput is yellowish brown becoming black near the top. *Thorax:* the mesonotum is moderately shining greenish to brassy black; the whole notopleura and the humeri and a wide stripe down the pleura are light reddish yellow; the postcalli and the scutellum are brownish yellow; the scutellum in oblique view appears to be darker brown upon the disc, its pile is quite sparse and short and blackish with here and there a reddish hair; the ventral scutellar fringe apparently is absent. The squamæ are dark sepia, the halteres reddish brown. *Abdomen:* first segment brownish yellow narrowly on the posterior margin with a few long, reddish brown hairs on the sides of the base; the second segment is sepia brown with very obscure, oblique oval spots on each side of the middle of the segment enclosed by obscure opaque color. The third segment is almost the shape of an equilateral triangle; it is sepia brown with obscure, reddish brown, quite oblique vittæ proceeding from the base of the segment and running to the sides and then reaching the sides of the segment close to the posterior segment. The area in the middle behind these vittæ constitutes a definitely opaque brown triangle in which, however, the posterior margin is obscure. The fourth segment has a complete, arcuate, rather narrow but reddish brown band which is somewhat lighter than the preceding vittæ; the area behind is obscurely opaque. The fifth segment is obscurely lighter brown in the corners and with a suggestion of an arcuate opaque band behind. *Legs:* anterior and middle legs entirely yellow; basal half of hind femora yellow, the apical half brown. The posterior tibiæ and tarsi are pale reddish brown with dark brown pile. *Wings:* light brownish yellow throughout, the pterostigma of a slightly darker shade of yellow brown and the apex of the marginal and submarginal cells with a more distinctly brown but very diffuse spot which shades gradually into the paler color. Alulæ well-developed though not much wider apically than basally.

Holotype: a female, La Suiza, Costa Rica, 12–IX; Pablo Schild. In the collection of Dr. A. L. Melander.

TWO NEW TIGER BEETLES FROM NEW GUINEA[1]

By P. J. Darlington, Jr.
Museum of Comparative Zoölogy, Cambridge, Mass.

The following two new species of the well-studied family Cicindelidae are of unusual interest. One is the second known species of *Caledonomorpha,* the only genus of the family confined to New Guinea. The other constitutes the first record for New Guinea of the widely distributed genus Prothyma.

Caledonomorpha milneana n. sp. (Fig. 1)

Similar in generic characteristics, and nearly similar in form and general appearance, to *Caledonomorpha jordani* W. Horn (1897, pp. 270–271; 1910, p. 179, t. 11, f. 12), but slightly smaller and less elongate. Color of body green; but labrum testaceous basally; top of head (except labrum) and pronotum (except at sides) bluish purple; elytra brown with bluish or purplish reflections and green punctation, and each elytron with 3 small marginal or submarginal white spots, one humeral, one before middle, one ante-apical; abdomen piceous except green at sides anteriorly, testaceous apically. Surface of body including elytra with distinct, fine, isodiametric or slightly transverse, reticulate microsculpture. Mandibles piceous, except testaceous externally in basal half; palpi testaceous, each with apical segment entirely or partly piceous; antennæ piceous; legs piceous externally (with green reflections on basal half of femora), testaceous internally. *Head:* with mandibles elongate, each with 4 long teeth about as in *jordani;* mentum tooth long and acute; labrum transverse, not quite so short as in *jordani,* irregularly truncate, with one seta each side and 2 near middle; eyes prominent; antennæ very elongate; palpi long, slender. *Prothorax* subquadrate, longer than wide, transversely impressed and slightly constricted near base and apex, with median longitudinal line less impressed;

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[1] Published with a grant from the Museum of Comparative Zoölogy at Harvard College.

disk slightly, transversely wrinkled, impunctate. *Elytra* relatively a little shorter than in *jordani;* each with outer apical angle spined, sutural angle not distinctly toothed, humeral prominence present but less developed and less acute than in *jordani;* surface moderately punctate, the punctures usually separated from each other by more than their own diameters. Male genitalia as figured.

Length 10–11; width between 3 and 3½ mm.

Holotype ♂ and one ♂ paratype both from north side of Milne Bay, eastern tip of New Guinea, December 1943, taken by myself. Types in the Museum of Comparative Zoölogy: Type No. 27734.

This new species is slightly smaller and less elongate than *Caledonomorpha jordani* W. Horn, differs in ground color of the upper surface, lacks a distinct tooth at the apical sutural angle of the elytron, has less prominent and less acute humeral prominences, and differs slightly in other ways.

Caledonomorpha is the only genus of tiger beetles peculiar to New Guinea. *C. jordani,* the only previously known species, is apparently confined to *eastern* New Guinea and adjacent small islands. It was described from Fergusson (Island) and the Astrolabe Mts., and in the M.C.Z. we have a series of 8 specimens from Mt. Lamington and Dobodura. It is rather surprising to find a second eastern New Guinea species at Milne Bay. In case Horn's original series may have been mixed, *I here designate the form figured in Genera Insectorum (W. Horn 1910, t. 11, f. 12) as typical* jordani. Possibly additional species remain to be discovered in western New Guinea.

I collected *C. jordani,* in northern foothills of the Owen Stanley Range near Dobodura, on stones and shrubs along small, very rapid brooks in heavy forest. Probably *C. milneana* lives in a similar habitat, although I do not remember the circumstances under which the types were collected.

Prothyma papua n. sp. (Fig. 2)

A rather small *Prothyma s. s.* Brown-bronze above, purplish blue below; elytra each with a narrow, irregular, yellowish white lateral vitta from behind humerus to apex; lateral (not apical) margin purplish blue, the color extending inward to form distinct marginal spots about ⅓ from base and just behind middle, and less distinct spots behind humerus and near apical ¼th; labrum bronze; mandibles and antennæ brown, latter paler near base; palpi irregularly brownish testaceous with apical segments darker; legs irregularly brownish testaceous, paler internally, with femora vaguely spotted or banded with darker before apex; posterior tibiæ paler toward apex, but actual apices dark; posterior tarsi with 2 basal segments pale, 3 outer ones darker. *Head:* with labrum long, 5-dentate, 4-setose, with deep, almost isodiametric, reticulate microsculpture; clypeus without setæ; eyes very prominent; antennæ long (in genus), first segment of each with a single seta in front near apex; upper surface of head (except labrum) rugose, the rugosity becoming longitudinal between the eyes and forming about 32 parallel, somewhat anastomosing striæ; mentum tooth

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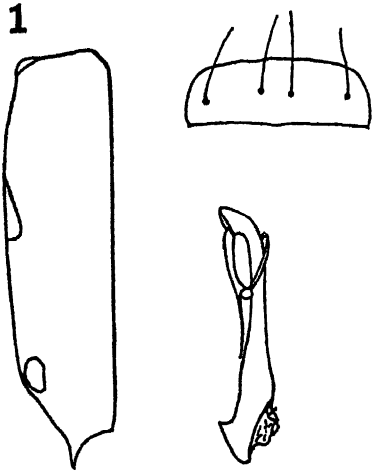

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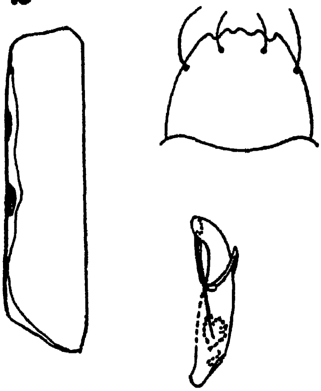

Fig. 1. *Caledonomorpha milneana* n. sp. (holotype). Camera-lucida outlines of left elytron (from perpendicular to suture), labrum, and male genitalia (from left, with left paramere).

Fig. 2. *Prothyma papua* n. sp. (holotype).

moderate, triangular; palpi slender (in genus). *Prothorax* small, quadrate, just wider than long (by measurement); pronotum with usual anterior and posterior transverse impressions; median longitudinal impression vague; surface rugose. *Elytra* obliquely sinuate-truncate at apex (more widely than usual); each with a small tooth at sutural angle; surface with microsculpture like labrum, and also moderately punctate, most of the punctures being rather small and separated from each other by much more than their own diameters; a few larger punctures, some bearing small hairs, scattered in basal ⅓ of disk and widely spaced in one line on each elytron parallel to suture to within ¼ of apex. *Lower surface* of body not distinctly punctate and not pubescent except for setæ on all coxæ and pairs of setæ on 4th and 5th segments of abdomen; 6th ventral (♂) deeply emarginate, without hairs (some hairs present on apparent 7th segment); thighs without hooked hairs. Inner wings fully developed. Male with 3 basal segments of front tarsus slightly dilated, white, and pubescent below (outer segments slender, dark); male genitalia as figure.

Length 8; width c. 2½ mm.

Holotype ♂ and one ♂ paratype, both from north side of Milne Bay, eastern tip of New Guinea, December 1943, taken by myself; ecological habitat not recorded. Types in Museum of Comparative Zoölogy: Type No. 27735.

To understand the relationships and geographical significance of this new species, one must understand first the previously known distribution of *Prothyma*. The genus in the strict sense includes some 50 species, of which a few are in Africa, many in Madagascar, 2 on Mauritius and Reunion, many in the Oriental Region east to Java and the Philippines, one in temperate China (W. Horn, 1935, p. 24), and one in southern Mexico in the edge of the American tropics. Until now, no *Prothyma* in the strict sense has been known east of Wallace's Line, but endemic subgenera, each with one or two species, are localized in Celebes, northwestern Australia (W. Horn, 1936, p. 22), New Caledonia, and Samoa (W. Horn, 1934, p. 144). These subgenera are marked either by a short labrum, or a bidentate labrum, or by reduction of width of head in relation to prothorax, characters that are not even suggested in the new New Guinea species. The latter is therefore not only the first *Prothyma* of any sort found in New Guinea, but it extends the known range of *Prothyma s. s.* into the Australian Region. It appears to be a very distinct species. It differs from most Oriental *Prothyma* (*e.g.*, from *quadripunctata* F. and *heteromalla* Macl. of Java) in elytral color pattern, which in most Oriental species consists of white spots on a dark or metallic background, but which in *papua* consists of an incomplete pale submarginal and apical vitta partly interrupted by incursions of the narrow marginal metallic color. The elytra are wider near the apex in *papua* than in any other *Prothyma* of which I have seen specimens or figures.

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INSECT RECONNAISSANCE IN LIBERIA, WEST AFRICA

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The Republic of Liberia lies approximately between 4° 22′ to 8° 50′ north latitude, and 7° 33′ to 11° 32′ longitude west of Greenwich. It has one of the most humid and rainiest climates of Africa. The rainy season begins in April and terminates in November, the annual rainfall being as much as 170 inches.

This paper is a report of an insect reconnaissance in many localities in the hinterland and coastal areas of Liberia. Collections were made throughout the year. Accordingly, an overall picture of seasonal distribution was obtained; this will be reported in a later paper.

In the following list families are arranged in accord with recent phylogenetic studies. Among the Diptera there are five new distributional records for Liberia and four undescribed species. Definite localities are given for all of the specimens.

Diptera

Tipulidæ

1. *Trentepohlia exornata* Bergr. Roberts Field; Harbel.

The collection also contains unidentified species of *Elephantomyia, Lecteria, Megistocera* and *Tipula* collected at Roberts Field and Harbel.

Bibionidæ

Unidentified species of *Plecia* collected at Roberts Field and Harbel.

Fungivoridæ

Unidentified species of *Cerotelion, Delopsis, Lycoria, Neoempheria* and *Trichosia* collected at Roberts Field and Harbel.

Tendipedidæ

Unidentified species of *Tendipes* collected at Roberts Field.

Heleidæ

Unidentified species of *Forcipomyia* collected at Roberts Field.

Psychodidæ

2. *Brunettia albonotata* (Brun.) Harbel.
3. *Telmatoscopus albipunctatus* (Will.) Roberts Field; Harbel.

Culicidæ

4. *Anopheles funestus* Giles. Roberts Field; Harbel; Gbanga.
5. *Anopheles gambiæ* Giles. Roberts Field; Harbel; Owen's Grove; Marshall; Kakata; Fisherman's Lake; Reputa; Salala; Cape Palmas; Grand Bassa.
6. *Anopheles hancocki* Edw. Roberts Field; Harbel; Fisherman's Lake.
7. *Anopheles nili* (Theob.) Roberts Field; Harbel.
8. *Anopheles paludis* Theob. New record for Liberia. Roberts Field.
9. *Aëdes* (*Aëdimorphus*) sp. very close to *filis* I. & M. Roberts Field.
10. *Aëdes ægypti* (L.) Roberts Field; Harbel; Kakata; Monrovia.
11. *Aëdes africanus* (Theob.) Roberts Field; Kakata.
12. *Aëdes luteocephalus* Newst. Roberts Field.
13. *Aëdes vittatus* (Bigot). Roberts Field.
14. *Culex annulirostris consimilis* Newst. Roberts Field; Harbel.
15. *Culex bitæniorhynchus* Giles. Roberts Field; Harbel.
16. *Culex guiarti* Blanch. Roberts Field; Harbel.
17. *Culex moucheti* Evans. Roberts Field; Harbel.
18. *Culex nebulosus* Theob. Roberts Field; Harbel.
19. *Culex tigripes* Gr. & Ch. Roberts Field; Harbel.
20. *Eretmapodites chrysogaster* Graham. Roberts Field; Harbel.
21. *Mansonia africana* (Theob.) Roberts Field; Harbel.

22. *Mansonia metallica* (Theob.) Roberts Field.
23. *Mansonia uniformis* (Theob.) Roberts Field.
24. *Megarhinus* sp. probably *brevipalpis conradti* Grünb. Roberts Field; Harbel.

The collection also includes unidentified species of *Ficalbia* (*Miomyia*) collected at Roberts Field.

Tabanidæ

25. *Chrysops longicornis* Macq. Roberts Field.
26. *Tabanus besti* var. *arbucklei* Austen. Roberts Field; Harbel.
27. *Tabanus par* Walk. New record for Liberia. Roberts Field.
28. *Tabanus kingsleyi* Ricardo. Roberts Field; Harbel.
29. *Tabanus postacutus* Oldroyd. New record for Liberia. Roberts Field; Harbel.
30. *Tabanus tæniola* Palis. de B. Roberts Field.
31. *Thaumastocera akwa* Grünberg. New record for Liberia. Roberts Field.
32. *Hæmatopota furians* Edw. New record for Liberia. Roberts Field.
33. *Hæmatopota guineensis* Bigot. Roberts Field.

Rhagionidæ

Unidentified species of *Suragina* collected at Roberts Field and Harbel.

Asilidæ

Two new species, *Laphria* and *Ommatius*, collected at Roberts Field.

Dorilaidæ

Unidentified species of *Dorilas* collected at Roberts Field and Harbel.

Syrphidæ

34. *Baccha brevis* Karsch. Roberts Field; Harbel.
35. *Melanostoma annulipes* Macq. var. *mauritianum* Big. Roberts Field; Harbel.
36. *Microdon brevicornis* Loew. Roberts Field.
37. *Microdon punctulatus* Wied. Roberts Field.
38. *Paragus borbonicus* Macq. Roberts Field.

39. *Protylocera æsacus* Walker. Roberts Field; Harbel; Kakata.
40. *Protylocera dibaphus* Walker. Roberts Field; Harbel; Kakata.
41. *Rhingia cærulescens* Loew. Roberts Field; Harbel; Kakata.

The collection also contains unidentified species of *Tubifera* and two new species, *Eumerus* near *triangularis* Hervé-Bazin, and *Graptomyza,* collected at Roberts Field.

Tephritidæ

42. *Ceratitis* (*Pardalaspis*) *giffardi* *Bezzi.* Roberts Field; Harbel.
43. *Ceratitis* (*Pardalaspis*) *punctata* (Wiedmann). Roberts Field; Harbel.
44. *Ceratitis* (*Trirhithrum*) *fraterna* Munro. Roberts Field; Harbel.
45. *Ceratitis* (*Trirhithrum*) *nigerrima* (Bezzi). Roberts Field; Harbel.
46. *Dacus armatus* F. Roberts Field; Harbel.
47. *Dacus punctatifrons* Karsch. Roberts Field; Harbel.

The collection also includes unidentified species of *Rhacochlæna* collected at Roberts Field.

Glossinidæ

48. *Glossina fusca* Walker. Roberts Field; Reputa; Kolobanu.
49. *Glossina nigrofusca* Walker. Roberts Field; Memmeta.
50. *Glossina palpalis* Rob.-Desv. Roberts Field; Kolobanu; Lengatown; Banga; Reputa; Memmeta; Kakata.

HYMENOPTERA

Chalcidoidea

Unidentified species of *Brachymeria*, *Cleonymus*, *Philomides* and *Ptinobius* collected at Roberts Field.

Braconidæ

Unidentified species of *Iphiaulax* collected at Roberts Field and Harbel.

Ichneumonidæ

51. *Idechthis canescens* (Grav.) Roberts Field; Harbel.

The collection also includes unidentified species of *Anomalon, Charops, Enicospilus, Melanichneumon, Pristomerus, Xanthocampoplex, Xanthopimpla* and *Zaleptopygus* collected at Roberts Field.

Tiphiidæ

52. *Tiphia pedestris* Gerst. Roberts Field; Harbel.

Scoliidæ

53. *Campsomeris albicollis* (Chr.) Roberts Field.

The collection also contains unidentified species of *Scolia* collected at Harbel.

Mutillidæ

54. *Timulla cyparissa* (Sm.) Roberts Field.

The collection also includes unidentified species of *Odontomutilla* collected at Roberts Field and Harbel.

Chrysididæ

55. *Chrysis lyncea* F. Roberts Field; Harbel; Marshall; Kakata; Reputa.

Formicidæ

56. *Dorylus* (*Dorylus*) *gribodoi* Emery. Roberts Field; Harbel; Monrovia; Salala.
57. *Dorylus* (*Anomma*) *nigricans* Illiger. Roberts Field; Harbel; Monrovia.
58. *Œcophylla longinoda* var. *fusca* Emery. Roberts Field; Harbel; Kakata.
59. *Paltothyreus tarsatus* (F.) Roberts Field.

The collection also contains unidentified species of *Crematogaster* collected at Roberts Field and Harbel.

Pompilidæ

60. *Cyphononyx croceicornis* (Er.) Harbel.
61. *Paracyphononyx zonatus* (Ill.) Roberts Field.
62. *Pseudagenia personata* Grib. Roberts Field.

The collection also contains unidentified species of *Anoplius* collected at Roberts Field.

Vespidæ

63. *Polistes marginalis* var. *ornatus* Lep. Roberts Field.
64. *Polybioides tabida* (F.) Roberts Field.
65. *Ropalidia cincta* (Lep.) Roberts Field.
66. *Belonogaster junceus* (F.) Roberts Field.
67. *Rygchium marginellum* (F.) Roberts Field; Harbel.
68. *Rygchium albonigrum* (J. Bequaert). Roberts Field; Harbel.
69. *Rygchium synagroides* (Sauss.) Harbel.
70. *Rygchium ventrale* (Sauss.) Harbel.
71. *Synagris calida* (L.) Harbel.
72. *Synagris cornuta* (L.) Roberts Field; Harbel; Marshall.
73. *Synagris spiniventris* (Ill.) Roberts Field; Harbel.

Sphecidæ

74. *Chalybion fuscipennis* (Sm.) Roberts Field; Marshall.
75. *Chlorion xanthoceros* (Ill.) Roberts Field; Harbel; Marshall.
76. *Motes crœsus* (Sm.) Roberts Field.
77. *Sceliphron spirifex* (L.) Roberts Field; Harbel; Marshall; Kakata; Salala.
78. *Sphex,* near *indutus* (Kohl). Roberts Field; Harbel; Marshall.

The collection also includes unidentified species of *Cerceris, Dasyproctus, Hoplisoides, Trypoxylon* and *Bembix* collected at Roberts Field. The last named specimen was also found at Kakata, Reputa and Salala.

Apidæ

79. *Trigona erythra* Schlett. Tototown; Salala.
80. *Trigona erythra togœnsis* Stad. Tototown; Salala.
81. *Trigona* (*Dactylurina*) *staudingeri* Grib. Roberts Field; Harbel.
82. *Anthophora cincta* F. Roberts Field; Harbel.
83. *Mesotrichia albiceps* (F.) Reputa; Salala.
84. *Mesotrichia gabonica* Vach. Roberts Field; Harbel.
85. *Mesotrichia imitator nigriceps* Friese. Roberts Field.

86. *Mesotrichia modesta* (Smith). Roberts Field; Harbel.
87. *Mesotrichia præusta* (Smith). Roberts Field.
88. *Mesotrichia torrida* (Westw.) Roberts Field; Harbel.
89. *Pasites nigerrima* Fr. Roberts Field.
90. *Euaspis abdominalis* (F.) Roberts Field; Harbel.
91. *Gronoceras prætexta* (Vach.) Roberts Field; Harbel; Marshall.
92. *Megachile crocutella* Ckll. Roberts Field.
93. *Megachile rufipes* (F.) Harbel; Reputa.
94. *Pachyanthidium xanthostomum* Ckll. Roberts Field.

The collection also contains unidentified species of *Xylocopa, Crocisca* and *Halictus* collected at Roberts Field and Harbel.

COLEOPTERA

Carabidæ

Unidentified species of *Anisodactylus, Craspedophorus, Ochyropus, Orthogonus* and *Pheropsophus* collected at Roberts Field.

Hydrophilidæ

Unidentified species of *Sternolophus* collected at Roberts Field.

Staphylinidæ

Unidentified species of *Pæderus* collected at Roberts Field.

Histeridæ

Unidentified species of *Hister* collected at Roberts Field and Harbel.

Lycidæ

95. *Lycus latissimus* (L.) Roberts Field.
96. *Lycus sinuatus* Dalm. or *semiamplexus* Murray. Roberts Field.

The collection also includes unidentified species of *Speckia* collected at Roberts Field.

Meloidæ

Unidentified species of *Zonabris* and *Zonitis* collected at Roberts Field and *Epicauta* found at Reputa.

Coccinellidæ

97. *Cheilomenes axillaris* Ws. Roberts Field; Harbel
98. *Chilocorus schiœdtei* Muls. Roberts Field; Harbel.
99. *Epilachna assimilis* Muls. Roberts Field; Harbel.

Tenebrionidæ

100. *Odontopus cupreus* F. Roberts Field.

The collection also contains unidentified species of *Eupezus, Opatrinus* and *Prioscelis* collected at Roberts Field and Harbel.

Lagriidæ

Unidentified species of *Lagria* collected at Roberts Field.

Scarabæidæ

101. *Odoretus luteipes* Cast. teste Ohaus. Roberts Field; Harbel.
102. *Anomala discordabilis* Dohrn. Roberts Field.
103. *Anomala imarginata* Ohs. Roberts Field.
104. *Archon centaurus* (F.) Roberts Field; Harbel.
105. *Diplognatha gagates* (Forst.) Harbel.
106. *Heteroligus meles* Bilb. Roberts Field.
107. *Incala lineola* Westw. Roberts Field.
108. *Oryctes monocerus* Ol. Roberts Field; Harbel.
109. *Pachnoda marginata* Drury. Roberts Field; Harbel.
110. *Pachnoda tridentata* (F.) Roberts Field; Harbel.

The collection also includes unidentified species of *Apogonia, Eulepida* and *Trochalus* collected at Roberts Field and Harbel.

Lucanidæ

Unidentified species of *Prosopocoilus* collected at Roberts Field.

Cerambycidæ

111. *Acanthophorus* (*Tithoes*) *palini* Hope. Owen's Grove.
112. *Monochamus ruspator* (F.) Owen's Grove.
113. *Sternotomus regalis* (F.) Roberts Field.

The collection also contains unidentified species of *Callichroma* and *Euporus* collected at Roberts Field.

Chrysomelidæ

114. *Callispa* sp. near *nigripes* Baly. Roberts Field.
115. *Cryptocephalus* sp. perhaps *dregei* Suffr. Roberts Field.
116. *Galerucella geniculata* Harold. Roberts Field.

The collection also includes unidentified species of *Aspidomorpha, Hispa* and *Monolepta* collected at Roberts Field and Harbel.

Anthribidæ

117. *Gynandrocerus antennalis* Lac. Harbel.
118. *Polycorynus* sp. probably *compressicornis* F. Roberts Field.

The collection also includes unidentified species of *Phlœtrogus* collected at Roberts Field.

Curculionidæ

119. *Rhynchophorus phœniciensis* F. Roberts Field; Harbel.
120. *Sipalinus guineensis* (F.) Roberts Field.
121. *Temnoschoita quadripustulata* (F.) Roberts Field.

The collection also contains unidentified species of *Lixus, Mechistocerus* and *Protocylas* collected at Roberts Field.

ORTHOPTERA

Blattidæ

122. *Leucophæa grandis* (Sauss.) Roberts Field.
123. *Periplaneta australasiæ* (F.) Roberts Field; Harbel.

Gryllidæ

124. *Gryllotalpa africana* Beauv. Roberts Field; Harbel.

DERMAPTERA

Forficulidæ

125. *Diaperasticus erythrocephalus* (Oliv.) Roberts Field; Harbel.

Labiduridæ

Unidentified species of *Eurollia* collected at Roberts Field.

Isoptera

Termitidæ

126. *Macrotermes bellicosus* (Smeathman). Roberts Field; Kakata; Salala; Reputa; Harbel.

Siphonaptera

Pulicidæ

127. *Ctenocephalides canis* (Curtis). Roberts Field; Kakata; Harbel; Monrovia.

Neuroptera

Myrmeleonidæ

128. *Palpares manicatus* Rambur. Roberts Field; Harbel.

SUMMARY TABLE

Orders	*Families*	*Genera*	*Species*	*Determined*	*Undetermined*
Diptera	14*	43	71	50	21
Hymenoptera	12	55	69	44	25
Coleoptera	15	55	56	27	29
Orthoptera	2	3	3	3	0
Dermaptera	2	2	2	1	1
Isoptera	1	1	1	1	0
Siphonaptera	1	1	1	1	0
Neuroptera	1	1	1	1	0
8	48	161	204	128	76

* The following families were not listed because of undetermined specimens: Empididæ, Therevidæ, Dolichopodidæ, Otitidæ, Piophilidæ, Phoridæ, Milichiidæ, Pyrgotidæ, Stratiomyidæ, Drosophilidæ and Diopsidæ.

Acknowledgments

The writer is indebted to Mr. C. F. W. Muesebeck and staff of the Bureau of Entomology and Plant Quarantine for aid in determining the specimens. Dr. Alan Stone determined the Culicidæ. Dr. Joseph Bequaert, Curator of Insects, Museum of Comparative Zoology, Harvard College, revised the Tabanidæ and Vespidæ.

A NEW GENUS AND SPECIES OF DAMSELFLY FROM SOUTHERN HAITI (ODONATA)*

By Kenneth A. Christiansen
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The new species herein described was collected by Dr. Marston Bates in September, 1934, at an altitude of 4,000 feet in the Laselle Mountains of Southern Haiti. It represents a strikingly new addition to the Neotropical fauna. Every external characteristic appears to point toward a relationship with the family Synlestidæ, and the penes have a remarkable resemblance to the penes of the African genus *Chlorolestes;* however, until the nymph has been uncovered, any family classification must remain a tentative one. Both Tillyard[1] and Lieftinck[2] have shown that the final court of appeal as to members of this family is the nymph. If we place this genus in the Synlestidæ, using Tillyard's divisions (*op. cit.*), it runs out to the subfamily Synlestinæ. This would bring the genus between the African *Chlorolestes* and the Australian *Synlestes.* The evidence of the penes and the venation seems to bear this out. If this genus is, as it appears to be, closest to *Chlorolestes*, this would mark another appearance of a new genus in the Neotropics whose closest ally is an African genus. In both genera the types were captured at high altitudes.

Phylolestes, new genus

Wings long and narrow, about seven times as long as wide. Petiolation ends well before the level of the quadrangle in both wings. In the fore wings Ac[4] is well distad of the level of petiolation and is opposite the midpoint between the two antenodals. In the hind wings Ac is slightly distad of the level of petiolation and is closer to the second antenodal than to the first; second antenodal on a level with the arculus; quadrangle strongly acute with the proximal side as long as, or longer than, anterior side; subquadrangle separated from the wing margin with this separation more marked in the fore wing; anal bridge arises distally directly from the distal angle of the quadrangle in the hind wings, and originates slightly below the quadrangle in the fore wings; vein Cu P swings up sharply on leaving the quadrangle; R4 plus 5 arises closer to the subnodus than to the arculus, and more than one cell before the subnodus; nodus located ⅓ of the distance from the base to the distal end of the wing; IR3 arises at subnodus; IR2 is deflected strongly toward the stigma; at least one true[5] sector between IR2 and R3, rising proximad to the level of the stigma; no oblique crossvein between R3 and IR3. Superior male abdominal appendages forcipate, inferiors rudimentary and plate-like. Penis typically Synlestine, lacking a terminal lobe and possessing a visible median spine.

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[1] Tillyard & Fraser, Aust. Zool. 9(2), pp. 15–30, Nov. 1938.

[2] Lieftinck, Treubia 17, pp. 45–61, March 1939.

[3] Needham, J. G., Amer. Mus. Novitat. No. 1081, July 17, 1940.

[4] Venational terms used in this paper are those of Tillyard and Fraser (*op. cit.*) except that Discoidal cell of Tillyard = Quadrangle.

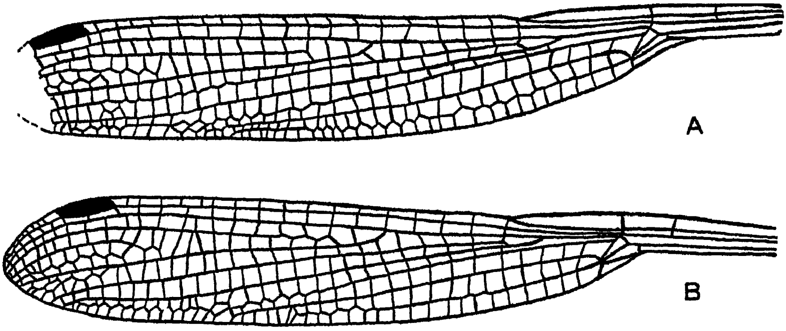

Fig. 1. Left fore (A) and hind (B) wings of *Phylolestes ethelæ* n. g. and n. sp., holotype. × 2.5.

The genus *Phylolestes* is very close in the shape of the penes to the African genus *Chlorolestes;* however, it may easily be separated from this genus by the venation and the shape of the inferior abdominal appendages. In

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[5] For the purposes of this paper a "true" sector is one which is straight for at least five cells length.

Chlorolestes the anal bridge originates distally well down the vein descending from the quadrangle in both wings, and joins the wing margin well before reaching Ac; Ac is opposite, slightly distad, or slightly proximad of, the level of the first antenodal; the wings are petiolated to, or nearly to, the level of the quadrangle; and the inferior abdominal appendages have a heavily sclerotized spiniform area. In *Phylolestes* the anal bridge starts at, or very close to, the distal angle of the quadrangle and runs into Ac before reaching the wing margin; Ac is opposite the midpoint between the first and second antenodals or closer to the second antenodal; the wings are clearly not petiolated to the level of the arculus; and the inferior abdominal appendages lack any heavily sclerotized area.

The distal origin of the anal bridge is similar to a condition found in the Australian genus *Synlestes,* while the condition of Ac resembles that of the Oriental *Megalestes;* but a separation of these three genera may easily be seen by an examination of the penes and a comparison of the venation.

Genotype.—*Phylolestes ethelæ.*

Phylolestes ethelæ, new species

Synlestine in appearance with moderately slender body; coloration metallic green, bronze and black.

Male.—Fore wing 38 mm.; hind wing 36 mm. Head (across eyes) 7 mm. Thorax plus prothorax[6] 9.5 mm. Abdomen, including the abdominal appendages, 56 mm. Greatest diameter abdominal segment 2 (excluding appendages) 2 mm., of segment 6, 1 mm., and of segment 9, 1.8 mm. Abdominal appendages 2 mm. long. Hind femur 6 mm., hind tibia 6 mm., mesothoracic femur 4.5 mm., mesothoracic tibia 5 mm., prothoracic femur 4 mm., prothoracic tibia 5 mm.

Head.—Labium obscure yellow, darker at its forward edge and cleft for more than ⅔ its entire length. Labrum shiny black. Genæ and postgenæ yellow. Anteclypeus dull yellow, postclypeus metallic green. Frons and ver-

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[6] Measurements for thorax plus prothorax taken at greatest length from base of head to abdominal segment 1.

tex metallic green. Ocelli black. Occiput bronzy. Eyes (in dried specimens) brown. Basal segment of antennæ with pale ring around distal half, remainder of antennæ black. Rear of head black with metallic green reflections.

Prothorax.—Anterior lobe dull brown edged with yellow. Lateral lobes dull yellow along inferior edges. Remainder of lateral lobes and the middle lobe dull bronze. Posterior lobe ridged and slightly curved along posterior margin. Posterior margin with a central roughly lunate depressed area. Color of posterior lobe dull bronze. Mesostigmal laminæ terminate on both sides at the anterior end of the humeral suture in a low barely acute angled lobe.

Thorax.—Mesepisternum black with metallic green reflections, an indistinct brown stripe originating at the humeral suture above and curving inward and down to the collar. A narrow yellow stripe along the humeral suture running from the mesinfræpisternum almost to the wing bases. Mesepimeron with small triangular yellow spot inferiorly tangent with mesepisternal yellow stripe. Remainder of mesepimeron brown with metallic green reflections rearward with the brown narrowing inferiorly. Metepisternum with a yellow hairline along 1st lateral suture bordered by brown. A yellow stripe extends

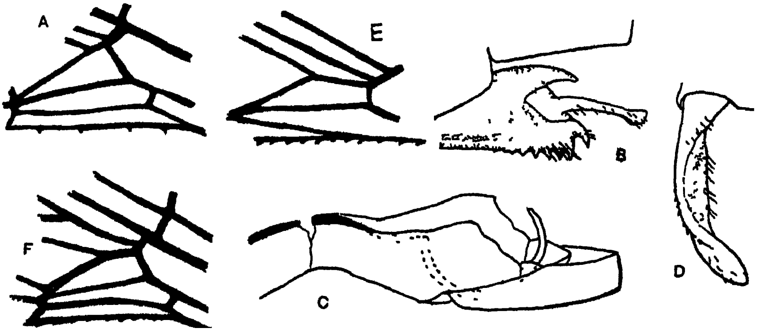

Fig. 2. A–D, *Phylolestes ethelæ* n. g. and n. sp., (A) area of quadrangle in left fore wing of holotype; (B) right genital valve of allotype in side view; (C) penis of holotype in side view; (D) left superior abdominal appendage of holotype in dorsal view. E, *Chlorolestes fasciata* Burmeister, area of quadrangle in left fore wing. F, *Megalestes major* Selys, area of quadrangle in left fore wing. All figures enlarged.

along the second lateral suture. The remainder of the thorax is dull brown fading to yellow posteriorly. Ante-alar sinus black.

Wings.—Postnodals in fore wing 18–?,[7] hind wings 16–16; R3 arises five and one-half crossveins distad of subnodus in fore wing and four to four and one-half in the hind wings. Stigma somewhat trapezoidal and three times as long as broad; proximal vein strongly angulate. The stigma covers two cells with brace vein slightly distad of the proximal end of the stigma.

Legs.—Coxæ yellow, femora and tibiæ light brown darkening towards the joints. Tarsi and claws black. Claws with a definite basal tooth. Spines short and stout on the femora; a little longer than the intervening spaces on the base of the tibia, decreasing in length toward the tarsi.

Abdomen.—The dorsum of segment one yellow basally, the remainder of the dorsum black with metallic green reflections, decreasing posteriorly. Ventrum obscure yellow. Anterior genital hamules roughly rhomboidal, yellow with black posterior edges. Superior abdominal appendages black, forcipate and simple, without any prominent spines or teeth. Inferiors rudimentary, consisting of small semicircular plates, dark brown in color.

FEMALE.—Length of fore wing 41 mm., hind wing 39 mm.; abdomen 46 mm. long and somewhat stouter than that of the male. Other measurements as in holotype.

Head.—As in holotype.

Prothorax.—Similar to the holotype except that the middle lobe is irregularly edged with black and the lateral lobes are inferiorly pruinose.

Thorax, ante-alar sinus, and mesostigmal laminæ as in holotype.

Wings.—Similar to holotype except as follows: stigma covers three cells in the fore wing and is not so strongly trapezoidal, with the proximal vein being more nearly parallel to the distal vein. Brace vein is in line with the proximal bordering vein. Stigma three times as long as broad. Postnodal crossveins: fore wings, 19–18; hind wings, 15–15.

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[7] Right fore wing of holotype is missing.

Abdomen.—Brown with metallic green reflections, blackening towards the terminal segments. Genital valves deeply serrate with the serrations recurved and increasing in size posteriorly. Ovipositor small and completely hidden by the valves.

Holotype male, allotype female, 1 broken teneral male and 1 female paratypes, vicinity of La Visite, Laselle Mts., Haiti, 4,000 ft. (Marston Bates). Museum of Comparative Zoölogy, No. 27733.

Not included in the type series is another male from the neighboring La Hotte range of Southern Haiti. This specimen has several differences from the Laselle specimens; however, the penis of the La Hotte specimen was badly damaged and in the portions remaining no differences were detected between it and the holotype. The observed variance between the other features is as follows:

Holotype	La Hotte male
Length—69 mm.	Length—58 mm.
Fore wing 33 mm. long	Fore wing 36 mm. long
Hind wing 38 mm. long.	Hind wing 34 mm. long.
Postnodal crossveins	
Fore wing 18–?	Fore wing 19–18
Hind wing 16–16	Hind wing 14–14

The thoracic and abdominal markings are similar, but the metallic green is more pronounced in the La Hotte specimen, and the brown colors on the thorax of the holotype become metallic bronze on the La Hotte male. The abdominal appendages are similar except for a small knob on the dorso-interior surface which appears only in the La Hotte specimen.

The poor condition of the La Hotte specimen and the small amount of available material make it impossible to say whether this La Hotte male represents another species of the new genus or only the normal variation for a species living in highly isolated areas.

I wish to extend my sincere thanks to Dr. Bequaert, Curator of Insects at the Harvard Museum of Comparative Zoölogy, for allowing me to study the material and for the aid which he furnished me during my study. I also wish to thank Mrs. Leonora K. Gloyd who read this paper and gave me many helpful suggestions about it.

NOTE ON THE TYPE SPECIMEN OF BAGOUS SELLATUS LECONTE (COLEOPTERA: CURCULIONIDÆ).—Leconte's description of *Bagous sellatus* (Rhync., p. 184) mentions that the elytra have "the striæ deep, interspaces convex, first, third, and fifth more elevated, the last terminating in a large conical tuberosity, which is surrounded by a black cloud." Blatchley (Rhync. N. E. Am., p. 236) redescribes the species and states, "sides and tips of elytra ash-gray, leaving a large, elongate triangular space black."

In 1942, when examining the type for Prof. Tanner, the present author subjected the specimen to degreasing in order to see the structural characters more easily. At this time the black cloud or spot disappeared, indicating that it had been merely an oil spot. It had been so symmetrical that it had misled both discriminating students.

The description stands on the basis of structural characters, the specimen now being entirely ash-gray. Any further specimens placed in this species because of possessing a black spot will undoubtedly turn out to be of another species.—FLOYD G. WERNER, Biological Laboratories, Harvard University.

A NEW STICTOPONERA, WITH NOTES ON THE GENUS (HYMENOPTERA: FORMICIDÆ)

By William L. Brown, Jr.
Biological Laboratories, Harvard University

Among ants collected in Western China during the years 1944 and 1945, I have two specimens of a new *Stictoponera* collected on a high, sharp ridge near Chao Kung Mountain and about one and one-half days' travel afoot west of Kuanhsien, Szechuan Province, China. The elevation was between 5000 and 7500 feet, probably closer to the higher altitude, in the zone of dense bamboo growth. The ants were taken together in the thin bamboo humus at the ridge summit. They moved very slowly, and resembled our species of *Proceratium* in their sluggish locomotion and in feigning death at the approach of danger.

Stictoponera panda new species

Holotype worker. Size, excluding mandibles, 5.2 mm. Length of thorax, Weber's measurement, 1.8 mm. Closely related to *tairanensis* Wheeler in possessing a high petiolar node with steep anterior and posterior faces. It differs from *tairanensis* mainly in its larger size, broader head (cephalic index, or greatest breadth of head expressed as a percentage of greatest length, mandibles excluded, is 93) and its different sculpture and color. The posterior corners of the head are also a little more acute. The eyes small, like those of *tairanensis*, with 6 to 8 ommatidia in the greatest diameter, placed near the middle of the sides of the head.

The frontal carinæ are slightly farther apart, and the longitudinal costulæ arising between them and continuing back across the vertex are finer and more numerous (four distinct costulæ in *tairanensis*, at least twice that many in *panda*, the more laterally placed costulæ with scattered shallow pits separating them). Clypeus very finely longitudinally striate, its median groove shallow and not bounded by definite carinæ laterally, somewhat shining. The declivity of the epinotum much less distinctly margined, the epinotal teeth obsolete, cross-rugæ on the face of the declivity much reduced and less distinct. For the rest, the sculpture is quite similar to that of *taivanensis*, but throughout lower and less distinct, especially of the dorsum of the thorax and first gastric segment.

Pilosity slightly shorter, more delicate and more abundant than in *taivanensis*. Color deep reddish ferrugineous, the node of the petiole slightly infuscated, antennæ and mandibles lighter, legs still lighter and more yellowish.

Holotype worker.—Taken near Chao Kung Mountain, west of Kuanhsien, Szechuan Province, China, Sept. 4, 1945. (W. L. Brown, Jr.) Type to be deposited in the Museum of Comparative Zoology.

Paratype worker.—One specimen. Total length excluding mandibles, 4.8 mm. Cephalic index, 92. Length of thorax, Weber's measurement, 1.7 mm. Otherwise quite similiar. This specimen collected with the holotype to be deposited in the U. S. National Museum.

This species is presumably different from *binghami* Forel, of which I have not seen specimens, in the size of the eyes, in sculpture, and in the shape of the petiole. *Binghami* is from Lower Burma, *taivanensis* from Formosa.

Stictoponera menadensis subsp. *minor* Forel

This form has been listed as a variety of subsp. *bicolor* Emery, from which it differs so markedly in color, if the specimen from Dong Mo, Indo-China is any criterion, that it should be regarded at the very least as of subspecific rank. This specimen, collected by Silvestri and now in the Wheeler Collection at the Museum of Comparative Zoology, is similar to *bicolor* in size and sculpture, but is a very light tannish-yellow in color, the gaster very slightly darker. The first funicular joint is more slender than in the Wheeler Collection specimens of *menadensis* Mayr or its subsp. *bicolor*.

Another series of workers from Borneo in the Wheeler collection are large for *Stictoponera*, ferrugineous red, and have the second gastric segment strongly costate. The genus is in such confusion that I am afraid of describing them as new without reliable examples of *costata* Emery, to which they are probably most closely related.

THE HABITAT OF ÆNIGMATIAS (DIPTERA: PHORIDÆ)

By C. T. Brues

Biological Laboratories, Harvard University

The sexes of the interesting genus *Ænigmatias* like those of many Phoridæ are extremely dissimilar owing to the apterous condition and otherwise profoundly modified and degenerate form of the female. Three species, known from the winged male have been found in North America. The female of one of these is known, definitely associated with the male from a pair taken *in copula* by Malloch and described by him as *Ænigmatias flavofemorata.* Malloch's types were from Illinois, collected "on a sandy bank along the Illinois Central Railroad between White Heath and the Sangamon River." As the genus is known definitely to be myrmecophilous, at least in Europe, the specimens taken by Malloch were quite probably from the nest of some ant in the vicinity. Previous to this a single female was taken in Arizona by Coquillett and described by him as *Æ. schwarzii.* Of this he says "it occurred on low vegetation in a locality where no ant nests could be found."

During the summer of 1945, the present writer collected a large number of miscellaneous insects on sheets of "tanglefoot" fly-paper in northwestern Massachusetts while making a census of insects to determine the effect of DDT on the insect fauna of woodlands. Among the more than 300,000 specimens obtained (of which some 51% were Phoridæ) was a single female of *Ænigmatias* from Petersham, August 4. This, which is apparently the third female to be reported from North America, was trapped on the trunk of a tree several feet above the ground. From this, and from the experience of both Coquillett and Malloch it is apparent that these tiny wingless *Ænigmatias* wander freely from the ant nests where they are domiciled, perhaps following foraging ants. This specimen is not sufficiently well preserved to determine whether it is *Æ. flavofemorata,* or more probably, *Æ. eurynota* Brues known from a male collected in 1910 by Mrs. Brues at Forest Hills, Massachusetts.

SOME CHARACTERS IN THE PERLIDÆ[*]

By Nathan Banks
Holliston, Mass.

Many years ago when I started to classify our Perlidæ I neglected to study the head, antennæ, and legs. In recent years others have emphasized the importance of genitalia and nymphal structure. Species are physiological units, genera are structural units. Reproduction is one of the most important physiological processes, so that the structure of the genital parts is of great value in species. These vary from species to species so that only in a general way can they be used for genera. If the genus is to be something different from the species, it must rest on characters which are not commonly used for species. Species reflect adaptation to environment, the recent and temporary life. Genera should rest on long-inherited structures, of little or no use to the adult, but which reflect heredity; characters common to several species.

The wings of *Pteronarcys* and *Isoperla* have many differences, but for each genus the wing is efficient; the great number of crossveins in the former genus is not necessary, they represent inheritance, not use, and so become of value in the classification of genera or higher groups.

Of the several structures that I have observed, the anal lobe of the fore wings[1] and a vein (anal brace), arising from the under side of the anal cell, and crossing the anal lobe seem to me to represent the course of specialization. In *Pteronarcys* the anal lobe is very large and the anal brace (vein that crosses it) complete and strong. In

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[*] Published with a grant from the Museum of Comparative Zoology at Harvard College.

[1] This anal lobe is rarely shown in figures of wings. Figure I in Needham and Claassen shows the anal area of fore wing but does not indicate the line of fold which separates the anal lobe from the rest of the wing. Many figures indicate the anal brace but often only partially or incorrectly. In the Selys part one, Klapalek on page 6 shows line of fold, in part 2, page 9, he shows the anal brace. N. & C. on plates 13 and 16 show the anal brace in *Perla* and *Acroneuria*.

Figures 1 to 8 I have indicated the gradual modification until it vanishes in *Peltoperla*. In *Pteronarcys* the anal brace extends obliquely backward (recurrent). Other general with an oblique recurrent anal brace are *Acroneuria, Togoperla, Banksiana, Neoperla, Perlesta, Pteronarcella, Harrisiola,*[2] *Perlinella.*

In *Isogenus* the anal brace arises closer to the base of the anal cell and extends transversely to the margin; other genera in this group are *Perlodes, Clioperla, Hydroperla.* Those in which the anal lobe is very small and folded under and the brace vestigial are *Isoperla, Paraperla, Diploperla,* some species placed in *Clioperla* (I am not sure of genotype). In *Atoperla* there is a very short basal part of anal brace arising before base of anal cell, often difficult to determine. In many cases the outer part of anal brace is weaker than basal part. In some species of *Isoperla* the lobe and brace are very small and weak or absent, in few distinct. In five genera the lobe and anal brace are absent: *Peltoperla, Alloperla, Chloroperla, Kathroperla,* and *Hastaperla.* In *Perlesta,* and sometimes other forms, the anal brace is bent at the line of fold.

ANTENNÆ.

The antennæ in Perlidæ are rarely mentioned except to note the color. Walker, in the descriptions of two species (*decolorata* and *decisa*) says antennæ "very minutely pubescent" and "brown, minutely pubescent."

The antennæ of *Pteronarcys* and *Acroneuria* have joints near the base very short and broad, some, at least immovable; in *Togoperla immarginata* it is similar. In *Perlodes* the joints near base are usually longer, but still broader than long; also in *Isogenus* and *Hydroperla.* In many of the species placed by Needham and Claassen in *Perla* and *Clioperla* the third joint is plainly longer than the fourth, the latter and several following joints being much broader than long. In this type of antennæ the joints are not narrowed at base until much further out where the joints are much longer than broad. In *Pteronarcella* the joints become longer than broad much sooner. In all of these the hairs on the antennæ are very small and fine, well described as "minutely pubescent." Often they are erect, but in some slope toward tip of joint. In *Togoperla* the hairs, though longer, are closely appressed; in *Perlinella*, though short, are also appressed.

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[2] *Harrisiola* (type *Perla flavescens* Walsh). I use this name for the species (except type) that were put by Klapalek in *Neophasganophora;* the type species being a *Perla.*

In the genotype of *Isoperla* (*bilineata*) the joints near base are as long as broad, the hairs are very short, but near the tip or beyond the middle is a longer erect hair, which I shall call a sense hair. In other species of *Isoperla* it is the same, but a few (*ebria*) that have sometimes been placed in *Isoperla* do not have these sense-hairs, or at least not well-developed. In *Alloperla*, in *Perlesta*, it is the same as *Isoperla*. In *Neoperla* the hairs are longer but the sense-hairs are very prominent, also *Diploperla*, *Paraperla*, and *Kathroperla*, as well as *Chloroperla* and *Hastaperla* have them more or less distinct.

In *Isogenus* and *Perlodes* there are no sense-hairs or else so small as to be unnoticed, in *Hydroperla* some species show very tiny erect hairs toward the tip of the joint, but in others they are very small or absent, in some *Diploperla* they are also short, but usually distinct and near tip of joint, in *Clioperla* (*similis*, *slossonæ*) they are readily seen. In some *Acroneuria* (*xanthenes*, *californica*) the sense-hairs are fairly distinct, beyond the short joints, in others they are obscure or absent. In the *Perlinæ* distinct, but not as prominent as in *Neoperla*.

HEAD.

In shape the head ranges from twice as broad as long (*Peltoperla*) to twice as long as broad (*Paraperla*); and behind the eyes the head may extend more than twice the diameter of the eye (*Kathroperla*) or there may be scarcely any space at all (some *Hydroperla*).

The head may be considered as of three areas: occipital area, the part behind eyes and ocelli; the interocular area, and the face or area in front of anterior ocellus. The occipital area is often very short in middle, where it is separated from the interocular area by a curved line or groove, the occipital line, the ends of which curve forward. Just behind the eyes the head usually narrows toward the pronotum, but in a few forms (*Perlodes, Atoperla*) the side at first bulges outward before it starts to narrow. In the middle there is frequently a line or groove from the occipital line to the rear of head; this median groove is present in *Perlodes, Isogenus, Chloperla,* some *Isoperla,* also in *P. nona* and *obscura.* It is short or hidden in *Perla* (*Togoperla*), *Acroneuria, Harrisiola, Perlinella, Perlesta, Atoperla, Alloperla,* but is present in *P. luctuosa, P. modesta* and *P. phalerata.* It is present in some very small species as *P. ebria.* In *Hydroperla* it is not present, at least in sight, but sometimes a small groove on the hidden part of head or as a very fine line.

The occipital line is usually quite distinct in the primitive forms; in the more specialized it may show behind the hind ocelli, or be entirely obliterated. In *Perlodes* it slopes each side and ends in front of eyes; in *Perliphanes* it slopes less and runs into lower part of eye; in *Perla* and *Acroneuria* it slopes each side just outside of boss and is stopped by a ridge. In *Calliperla* it slopes each side a little concavely to a point near eye where it connects with a line sloping below inwardly, the outer part of the M-mark. In *Harrisiola* and *Atoperla* it makes a full semicircle, the ends running into the boss; in *P. modestus* it makes a broader curve, also ending in the boss each side, but not a full semicircle. In *Isogenus* it is lower and broad, stopping near boss. In *Perlinella* the sides disappear a little beyond boss. In *Perlesta* it connects top of ocelli, beyond vestigial. In *Isoperla* it sometimes shows sloping from behind the hind ocelli toward the eye, but more often it is not visible.

The interocular area has the three (or two) ocelli. They form a triangle as long or longer than broad in *Perla, Acroneuria, Harrisiola,* and some *Perlodes;* in *Isogenus, Pictetia,* many *Chloperla* and *Isoperla* the triangle is broader than long or at least as broad.

The hind ocelli are usually situated at about the middle of the eye-space; in *Perlinella* and *Kathroperla* a little behind eyes, in *Alloperla* further back than usual, and sometimes behind the eyes. In *Isogenus, Hydroperla, Clioperla* and some related species the hind ocelli look more or less laterally from the head of a broad groove, there being a ridge on their inner edge as high as the ocelli; in *Isoperla* the hind ocelli look more upward; in *Acroneuria, Alloperla, Harrisiola* the hind ocelli project above the surface of the head. The distance of the hind ocelli from the eyes is, at most, only a character of species.

In nearly all Perlids there is a small swollen spot a little in front of each hind ocellus, and often further out. This is the lateral tubercle or boss. It is more or less characteristic in shape and position for each species. Sometimes hardly further than the diameter of the ocellus, again it may be five to ten times as far away. In a few cases it is circular, but usually longer than the ocellus, and one end may be enlarged, or narrowed at outer end. In front of the anterior ocellus is the face.

There is usually a transverse groove or a depressed spot in front of the anterior ocellus. In front of this there is on each side a smooth area, or raised area, usually elongate and sloping outward; frequently they are pyriform. These are the middle part of what Needham calls the M-mark; however it is better called the V-mark, since the outer sides are faint or absent in most species. Sometimes the two are joined together above in a broad curve. They never reach the front margin of head, and near each lateral corner may be a dark rounded spot. The shape and divergence of the V-mark are very good characters for species and species-groups. But sometimes widely separated genera may have the V-mark of very similar shape. I have figured a number of these, and I think they should be considered in descriptive work.

In some species the head is without marks, or only dark around the ocelli, but in many there is a pattern of dark marks, which has long been recognized of specific value. There is, of course, variation in the development of a pattern. When the same pattern occurs in two or more species, there are differences in structure; often in shape of the ocellar triangle or on the lower face.

The head of *Perlodes*, when viewed from above, shows the side behind each eye somewhat swollen before it begins to slope inward. Behind the eye of *Isogenus* the side is, at first straight, then slopes inward; in *Hydroperla* it is less distinct, since the head is shorter behind the eyes, but in *ebria* and *gravitans*(?) the side is plainly prominent before sloping. The last two species, when viewed from below, show a somewhat globose area behind the eye. In many species the side behind eye is convex, but it begins to slope at the eye. *Perlinella* and *Calliperla* show the side somewhat swollen before the slope.

FEMORA.

The femora have on their lower edge a row of short, fine hairs or the hairs may have above them a row of stouter bristles, or the hairs may be more numerous and spreading up on the lower part of the femur, and with bristles interspersed or in a row. Those with the row of short fine hairs are the genera *Perlodes* (and subgenera), *Isogenus*, *Hydroperla*, *Clioperla* and *Isoperla*, the other genera have bristles besides the hairs. In the *Perla* and *Chloroperla* sections there are always bristles on the femora, either in a row or among the hairs.

In shape the femora may be very long and slender, with nearly parallel sides, but in many of the genera with bristles among the hairs (*Perlesta*, *Neoperla*, Calliperlinæ) the femora are shorter, broader, and the upper edge convex.

WINGS.

Needham and Claassen in the table to species of Perla use the position of the cubito-anal cross-vein to divide the genus in two sections, one in which this cross-vein is placed its length beyond the end of anal cell, and the other where the cross-vein is at end of cell or only a trifle beyond. In general it would be better to divide whether the cross-vein is at or before end of anal cell, or plainly beyond. The amount beyond varies a bit in some species. It is plainly beyond in *Isogenus*, *Hydroperla*, *Perlodes*, *Perlinella*. In *Pteronarcys* this vein is much beyond end of cell, so we may consider this a primitive character.

However in *Isoperla* both ways occur commonly, even sometimes in the same specimen.

One point in venation is very interesting, it is the forking of the cubital vein in fore wings; in all but two subfamilies the cubitus forks in such a way that the anterior branch diverges at least a little, but plainly, from the main stem while the lower branch either runs out nearly as a continuation of the stem or also diverges from the stem, so if stem were continued it would divide the fork. In two subfamilies, the Isoperlinæ and the Chloroperlinæ the upper branch runs out as a continuation of the stem and the lower branch definitely diverges from the stem. These two subfamilies, although having much general resemblance, differ so much in details of structure that this similarity in forking of cubitus may be the result of similar needs for strengthening the flight structure.

In the primitive forms there are more costal crossveins, and more branches to the radial sector than in more specialized forms, but the result is not constant, but highly variable. One point is of interest, the origin of the radial sector is usually a little beyond the end of the first anal vein, if one moves further out so does the other, *Perlinella* having both points further out than in *Perlesta*. However in *Perla immarginata*, in *Perlinella*, sometimes in *Acroneuria* the radial sector arises before end of anal vein, and in *Hydroperla* and *Calliperla luctuosa* often opposite. The position of the cord, is usually at beginning of outer third, of wing; in *Perlesta, Calliperla*, some *Acroneuria* it is before end of second third, while in *Perlinella*, and in some *Clioperla* it is beyond end of second third.

In the more primitive genera the subcosta extends out to the cord or near it, and in a few, *Acroneuria, Perlodes, Perla,* it may extend beyond the cord. In *Isogenus, Calliperla, Harrisiola, Peltoperla, Atoperla*, and *Kathroperla* it reaches the cord, or nearly so. In *Alloperla, Paraperla, Isoperla* the subcosta ends well before the cord. Sometimes it may fade out or be very indistinct as in *Nanoperla* and *Perlesta* (some species).

The number of veins in the anal area of the hind wings is normally five, *Paraperla* has but four, *Alloperla* three, and *Hastaperla* has no anal area. In most genera the second and fifth are branched, in some *Acroneuria* and *Perla* with several branches.

In the hind wings the number of cubital cross-veins, if more than one, has been used, it varies, but is somewhat useful. The number of branches of the second and last anal veins, is also helpful, but rarely dependable. The length of the union of radial sector and medius has also been used, but too variable for a generic character.

PALPI.

The palpi in *Pteronarcys, Perla, Acroneuria* are short and inconspicuous, the last joint of the maxillary palpi very small, the third somewhat swollen at tip; in *Isogenus,* the fourth joint is longer, and in some species (*nona, ebria,* etc.) the palpi are much longer and more slender, the fourth joint prominent and the third joint not swollen at tip, while in *Alloperla* the last joint is very short, scarcely noticeable.

SETÆ.

The setæ, or tails, in the primitive forms (*Perla, Acroneuria, Peltoperla*) are short and in *Perla* and *Acroneuria* much thickened at the base and taper to the slender tip. The first few joints in *Perla* are simple annulations, not real joints; in *Acroneuria* they are usually more like a joint, plainly separated by a notch on the side; in *Peltoperla* some species are similar to *Perla,* in others more distinct. Also in *Perlodes*, and *Hydroperla* some species have short setæ, the basal joints scarcely separated. But in most Perlidæ the setæ are long, often as long as abdomen, and with many joints much longer than broad, and with long erect bristles near tip of each joint.

RESULTS.

On considering these characters in the various genera one sees that there are two primary trends or groups of primitive Perlidæ, one the *Acroneuria* group distinguished by the oblique anal brace arising from near third anal vein, the other the *Isogenus* group with an anal brace arising from the base or near base of anal cell and extended transversely across anal area and anal lobe when present. In the specialization that occurs in both lines, there comes reduction in venation, reduction in anal lobe, and many modifications that will be of use in the particular group.

Both groups have a fringe of hair on lower edge of the femora, in *Perlodes* and *Isogenus* very fine and evenly short, in *Acroneuria* more dense and with some stiffer and longer bristles. Both groups have the basal antennal joints very short, but in each line they become longer in more recent genera. In both lines the anal brace gradually weakens and disappears. In the *Acroneuria* line there is more tendency to retain and develop the bristles; but bristles appear in some of the fairly primitive genera of the *Isogenus* line, such as *Calliperla* and *Diploperla;* but in the more specialized forms (*Isoperla*) the bristles disappear, while in the most specialized group (Chloroperlinæ) of the *Acroneuria* line the bristles are most highly developed.

With the numerous similarities, as well as the differences, of structure in the group, it appears to me that in the Plecoptera there are, as Newman in 1853 stated, but three families, Pteronarcidæ, Perlidæ, and Nemouridæ, and that under the Perlidæ are eleven subfamilies, which are tabulated below.

Two courses are open in making a key to the subfamilies. In both *Isoperla* and *Alloperla* the forking of the cubitus in fore-wings is such that the upper branch of cubitus goes out straight as a continuation of the stem, while the lower branch (cubital fork) plainly diverges from the stem and upper branch of cubitus. In all other Perlidæ the forking of cubitus is so that the upper branch diverges from the stem, plainly at least a little. But the Isoperlinæ and the Chloroperlinæ (*Alloperla*) differ in so many ways, and, as I believe, the Isoperlinæ are an offshoot of the Isogeninæ that I think it better to take out the Chloroperlinæ much before the Isoperlinæ.

Another matter permits of two solutions. Whether to put together all those forms which have femoral bristles, or to dispose of them according to the forking of the cubitus; I have chosen the latter course. Bristles are ancestral, and the occurrence of ancestral characters in descendants is not unusual.

I had started this paper in order to do identification, especially of New England Perlidæ, and had hoped to rely chiefly on body characters, but find (as others have) that there is much in the wing, particularly the basal portion that is sufficiently constant for synoptic purposes. I do not underrate male genitalia and am pleased to find that in general my results agree with the plan made by Ricker in 1943.

Table to the Subfamilies of the Perlidæ

1. Head longer than broad, eyes situate more than twice their diameter from hind margin; in the forking of cubitus the upper branch is bent a little from the stem; the third anal vein arises from the cell; no anal lobe nor anal brace; antennæ with a few joints near base short; a carina or line connecting eyes and passing just behind hind ocelli. Kathroperlinæ

   If head is longer than broad the eyes are not more than one and one-half diameter from the hind margin 2

2. Small forms less than an inch; no anal lobe nor brace; anal area of hind wings with not more than four longitudinal veins; distinct erect bristles in a row on each side of femoral groove; occipital line absent or indistinct; antennæ rather long, not thickened at base, the joints moniliform; usually in the fore wings the third anal vein branches from the second beyond the anal cell Chloroperlinæ

   Anal area of hind wings with more than four longitudinal veins; in the fore wings the third anal vein leaves the second at or before end of anal cell 3

3. But two ocelli 4

   With three ocelli 6

4. Head about twice as broad as long, partly under the overhanging pronotum, latter very broad, rounded behind, straight or slightly concave in front; legs

short; setæ very short, but basal joints distinct; costal cross-veins numerous Peltoperlinæ

Head usually longer; pronotum usually a little convex in front; setæ not especially short 5

5. Ocelli hardly three diameters apart; anal brace distinct, extending obliquely back; femora with bristles among the hairs, no cross-veins between first and second anal veins Neoperlinæ

Ocelli fully four diameters apart; anal brace faint or absent, usually a few cross-veins between first and second anal veins *Atoperla* in Perlestinæ

6. In fore-wings there is an obliquely recurrent anal brace, often arising near base of third anal vein. Third antennal joint not or little longer than the fourth joint; cubito-anal cross-vein usually at or before end of anal cell; lower edge of femora with fine hairs and some longer bristles 7

In fore wings the anal brace, if present, arises from nearer the base of the anal cell, and extends transversely across anal area and anal lobe (if present); often anal brace faint or absent. Third antennal joint much longer than broad, and sometimes narrowed in middle; cubito-anal cross-vein frequently beyond end of anal cell, and first anal vein may be bent at that point. The lower edge of femora has a row of fine, usually short hairs, but sometimes with longer bristles present 9

7. Setæ fairly long, not noticeably thick near base, the joints soon as long as broad, the fourth not several times as broad as long, often with long erect bristles at tip of joints; wings with few, if any, cross-veins beyond the cord; sometimes a few cross-veins in anal area; in male the genitalia are not visible from above Perlestinæ

Setæ fairly short, thickened at base, the first few joints usually three or four times as broad as long, and not notched at base; usually a number of joints of antennæ toward base much broader than long . 8

8. Radial sector beyond cord usually forks three times, and the forks slope behind the sector, so sector fairly parallel to radius; usually some cross-veins beyond the cord; last joint of maxillary palpi usually one-half of fourth joint. In male no process or extension of fifth dorsal segment, but on ninth ventral segment is a raised median disc; subcosta often ends beyond cord Acroneurinæ

Radial sector usually with but two forks and the first parts into an anterior as well as posterior branch; no series of cross-veins beyond cord, subcosta often ends before or at cord; last joint of maxillary palpi usually not one-half of fourth joint. In male the fifth segment is usually extended, and the genital prongs wholly visible from above, no median disc on the ninth ventral segment Perlinæ

9. Both wings with cross-veins beyond the cord forming several irregular cells; the portion of fore wing beyond cord rarely a third of wing-length; the cubito-anal cross-vein is well beyond the end of anal cell; ocellar triangle usually as long as broad; anal lobe distinct and quite long Perlodinæ

Wings rarely with cross-veins beyond the cord, and not forming several cells; portion of fore wing beyond cord usually fully one-third of wing-length 10

10. In the forking of the cubitus in the fore wing the upper branch bends a little upward at the forking, while the lower branch also bends down a little, rarely in a curve or else does not bend at all. Radial sector often forks two or more times. Often with more than one cubital cross-vein in hind wings; cubito-anal vein sometimes broken 11

In the forking of the cubitus, it is the upper branch which continues the straight course, and the lower one diverges usually in a curve. Radial sector rarely forks more than once, and usually but one cubital cross-vein in the hind wings. The fourth joint of antennæ is usually as long as broad, and the sense-hairs distinct; median groove rarely present; cubito-anal vein normally not broken. Isoperlinæ

11. Femora with bristles below among the shorter hairs; anal lobe very small Calliperlinæ
Femora with only the fringe of short hairs below. Isogeninæ

REVIEW OF SUBFAMILIES AND GENERA

Subfamily Perlodinæ

Hanson has arranged the species of this subfamily on sternal structure, and, I believe, is continuing his work, so I have not utilized sternal structure in this paper, although I have previously (1938) based a genus, *Hesperoperla,* on such characters, and in fact have called attention to the value of ventral structure many years ago (1900).

The only point I would make is that I think his *Dictyoperygella washingtoniana* belongs to the Isogeninæ, close to or the same as *Hydroperla;* and add a new genus, differing from *Perlodes* in the presence of bristles on the femora.

Perliphanes gen. nov.

Type: *Dictyogenus* (?) *phaleratus* Smith.

Head plainly broader than long; ocellar triangle a little broader than long, hind ocelli rather small, looking laterally, nearer to each other than to eyes; median groove reaching occipital line; palpi rather short, third joint thick, longer than fourth, last joint one-half of fourth; pronotum twice as broad as long, sides parallel, as also front and rear sides; setæ short, several joints beyond first broader than long. Wings with some cross-veins connecting branches of radial sector, thus forming cells much like *Perlodes.* Upper branch of cubitus bends at the forking; cubito-anal vein at end of anal cell, first anal vein not here angled; anal lobe does not reach lower end of anal cell; a transverse brace across anal area from near base of anal cell. The femora have bristles among the shorter hairs.

Subfamily Calliperlinæ

Cubito-anal vein at or near end of anal cell; the first anal vein not angled or scarcely so near base; femora have distinct bristles among the shorter hairs.

1. Pronotum in front fully twice as broad as long; head extending back of eyes for the length of an eye; ocellar triangle twice as broad as long; last joint of maxillary palpi very short; radial sector forked twice *Calliperla*

   Pronotum not so broad, head not extended so far back, ocellar triangle rarely twice as broad as long 2

2. Maxillary palpi long and slender, the joints not broadened at tip; radial sector usually forks twice. *Diploperla*

   Maxillary palpi shorter, one or two joints plainly thickened near tip; radial sector often forked but once *Occiperla*

Calliperla gen. nov.

Type: *Perla luctuosa* Bks.

The ocellar triangle is twice as broad as long; hind ocelli nearer to eyes than to each other, head curving back of eyes more than length of eye. Ocellar line angulate behind, the median groove very short. Palpi very long and slender. Femora with distinct longer bristles besides the short fringe. Pronotum more than twice as broad as long. In fore wing the subcosta ends at or near cord, radial sector usually forks twice, cubito-anal cross-vein at end of anal cell, first anal vein not angled; in hind wing several cubital cross-veins. From base of anal cell in fore wings there is short, transverse anal brace, but no anal lobe; antennæ with several joints beyond the third much broader than long, with only minute erect hairs.

Diploperla Frison

This genus is based on *D.* (*Perla*) *bilobata* N. & C. This is a rather slender species in which the male shows a lobe on two ventral segments (*D. duplicata* is similar). The other forms are rather more robust, and the male has but one ventral lobe. But for the present I will keep them together; they are *modesta, verticalis, nona, tincta, sorpta* and probably *misnoma, alameda, æstivalis,* and *fulva.*

Occiperla gen. nov.

Type: *Isoperla pinta* Frison.

Head broad, behind eyes it at once slopes inward; median groove well developed; ocelli small, lateral boss about as far from hind ocellus as from base of antenna; femora with bristles among the shorter hairs; maxillary palpi moderately short, second and third joints rather thick, fifth long and slender; antennæ with moderately long joints, short hair, and minute sense hair near end of joint; pronotum much broader than long; cubito-anal cross-vein at end of anal cell; cubitus forks so both branches are at an angle with the base; anal brace arising a little before base of anal cell, transverse, no distinct anal lobe.

I have *Occiperla pinta* from Huntington, B. Col., and Cowichan Lake, Vancouver; there are at least two other species in the West, both with the area in front of anterior ocellus wholly yellowish, one with a pale longitudinal streak in the ocellar area, the other with ocellar area covered by a triangular dark spot.

Subfamily Isogeninæ

1. The anal lobe fairly large and long, ending beyond the lower end of anal cell; in hind wings a series of cubital cross-veins; moderately large specimens 2

   The anal lobe very small or absent, and if present it ends before the lower end of anal cell; usually smaller species 3

2. Ocellar area about as broad as long, or nearly so; head extending some distance behind eyes and plainly a little swollen before sloping inward; median groove nearly or quite reaching occipital line *Isogenus*

   Ocellar area but little if any broader than long; head very short behind eyes, scarcely space for more than the inward slope; median groove not reaching the occipital line *Hydroperla*

3. Hind ocelli far from hind border of head, not under a ridge, nor a shallow groove reaching laterally, but projecting a bit above surface, anterior ocellus almost as near each eye as to anterior margin of

head; fourth antennal joint fully as long as broad. *Megahelus*

Hind ocelli not so far from hind border of head and looking out over a broad shallow groove toward eye or antennæ; anterior ocellus much farther from either eye than from anterior border of head 4

4. Ocellar area about twice as broad as long; median groove complete and distinct; wings moderately broad *Pictetia*

Ocellar area plainly not twice as broad as long; median groove sometimes complete, often not, wings not so broad *Clioperla*

Clioperla N. & C.

This genus, proposed by Needham and Claassen, is based on the *Isogenus clio* Newman. Through the kindness of Mr. Kimmins of the British Museum I have learned of the generic characters which places the genus in the above table. The type is from Georgia, N. & C. identified specimens from North Carolina and Indiana. I have not been able to see these specimens; Frison saw them and said[3] that the specimens from Raleigh, N. C., are the same as his *confusa*. Specimens sent, as paratypes of *confusa*, by Frison to the M.C.Z. are very different from *clio*. In the M.C.Z. are two specimens from Woodworth Lake, Fulton Co., N. Y., which agree with color description I made of the type in 1912. The species is very close, perhaps the same, as that later described by Pictet as *Perla maculata*. Specimens that I have identified as *maculata* are from North Carolina and the White Mts., N. H.; these are smaller than *clio* and the tip of abdomen yellow, and the subgenital plate less strongly rounded.

Pictetia gen. nov.

Type: *Perla expansa* Bks.

The anal lobe is very small and short, the brace scarcely distinct; cubito-anal vein beyond tip of anal cell; palpi long and slender; back of eyes the head slopes inward.

---

[3] Bull. Ill. Nat. Hist. Survey 22: 331. 1942

Isogenus Newm.

This remains as used in Needham & Claassen.

Hydroperla Frison

This includes besides the species mentioned by Frison, *varians, subvarians, hastata, guerini.*

Megahelus Klap.

This is based on *Isoperla bellona* Bks.; it has much resemblance to typical Isoperla, but the cubitus forks as in *Isogenus*. There are apparently one or two more species.

Subfamily Isoperlinæ

1. Hind ocelli almost twice as near eyes as to each other, ocellar triangle fully twice as broad as long; pronotum plainly more than twice as broad as long; spines under tibiæ stout and long; small black species *Nanoperla*
   Hind ocelli not so near to eyes, and ocellar triangle not so broad 2
2. Femora with distinct longer bristles among the shorter hair; cubito-anal cross-vein at end of the anal cell *Perliola*
   Femora with only the fringe of short, even hairs 3
3. Hind ocelli looking laterally out over a broad, shallow groove toward eye or antenna; inner edge of ocelli scarcely above the middle surface; mostly more or less marked with brown; sometimes with extra cubital cross-veins in hind wing *Walshiola*
   Hind ocelli looking more upward, inner edge usually a little above surface between ocelli; no shallow groove, at most a small, subtriangular pit just outside of ocellus; mostly pale species; rarely with extra cross-veins in cubital area of hind wings. *Isoperla*

Isoperla Bks.

This I reduce to the forms similar to the genotype (***bilineata***) in having the cubitus forked so that the upper branch is continuous and the lower branch arising from it at an angle or a curve; and further as in the above table. This is closely similar to the condition in *Alloperla.*

Nanoperla gen. nov.

Type: *Chloroperla minuta* Bks.

This was placed in *Isoperla* by Needham and Claassen and by Frison. It differs from *Isoperla* by the more widely separated posterior ocelli, fully twice as far apart as each from eye; by the lack of an angle at anterior corners of the pronotum; in the hind wing the median cell is fully twice as long as its pedicel; the legs and setæ are shorter; the medius of fore wing is often stopped by the first median cross-vein, and does not extend basally close to the radius as is common in Perlidæ, this is similar to *Hastaperla* and *Chloroperla;* in the anal area the third anal vein usually branches from the second at the end of anal cell, sometimes a little beyond, rarely before it. Its dark fore wings with the costal area yellowish also separates it from Isoperla. In both sexes the genitalia are different from the normal Isoperla.

Nanoperla minuta occurs in the mid-western States, Ohio, Michigan, Illinois. It may be, as Frison suggests, that it is the *Chloroperla nana* Walsh. His description is short, and the size is a little large for a dried specimen; his unique type was from Rock Island, Illinois; Frison says that *minuta* occurs in the central and eastern part of Illinois.

Walshiola gen. nov.

Type: *Perlinella signata* Bks.

In Isoperlinæ, the upper branch of cubitus continues the line of the base; cubito-anal at tip of anal cell or a little beyond; radial sector forked once or twice; the head back of eyes at once curves inward; median groove usually reaches the occipital line, which, beyond each ocellus fades; hind ocelli looking out laterally over a broad, shallow groove; ocellar triangle a little broader than long; a rather wide space between arms of the V-mark; fourth antennal joint about or fully as long as broad; palpi long and slender, fourth joint rather longer than third.

Contains also *montana* Bks. and *marlynia* N. & C.

Perliola gen. nov.

Type: *Isoperla 5-punctata* Bks.

In this the cubitus forks as in typical *Isoperla,* but the femora are usually thicker (front pair) and with more numerous hairs and among them longer bristles; the ocelli are small, the lateral boss about as large and almost as far from hind ocellus as from the base of antenna; median groove present and usually visible. The maxillary palpi are short, the second and third joints at least rather thick; the joints of antennæ though much longer than broad are not as long as in *Isoperla,* and the hair is usually shorter. There are several species in the Western States, one with much resemblance in subgenital plate to *Isoperla sobria* Hag.

Subfamily Perlestinæ

The three genera in our fauna are separable as follows.

1. A series of costal cross-veins (five to ten or more) before end of subcosta; head broader behind than long; no cross-veins connecting anal veins beyond cell; three ocelli; first anal ends before origin of radial sector ....*Perlesta*
   First anal vein usually ends about as far out as origin of radial sector; rarely more than one or two costal cross-veins before end of subcosta; head sometimes as long as broad; often one or more cross-veins in anal field 2
2. With but two distinct ocelli; rarely with more than one or two cross-veins between first and second anal veins; front femora about equal to width of pronotum .. .. *Atoperla*
   With three ocelli; usually three or more cross-veins connecting first and second anals; front femora not as long as width of pronotum ....*Perlinella*

Subfamily Neoperlinæ

There is but one genus, *Neoperla,* in the U. S., others with many species occur in tropical areas and in East Asia.

Subfamily Acroneurinæ

The numerous species of this subfamily are placed in *Acroneuria, Claassenia, Eccoptura, Beloneuria,* and *Hesperoperla.*

Subfamily Perlinæ

The few genera, *Perla, Togoperla, Banksiana, Harrisiola,* have been separated by Klapalek and others; it is necessary to distinguish the female of *Harrisiola* from *Perla* (*Togoperla*). In *Harrisiola* (both sexes) the occipital line ends on the outer end of the lateral boss, in *Perla* the line does not bend forward so far, but runs toward the eye, well behind the boss. *Perla* has a tiny last joint to maxillary palpi.

Subfamily Kathroperlinæ

We have in America but the typical genus which occurs in British Colombia and adjacent areas. There are other genera in Formosa and China.

Subfamily Chloroperlinæ

The four genera, *Paraperla, Alloperla, Chloroperla,* and *Hastaperla,* were tabulated by Frison in 1942.

Subfamily Peltoperlinæ

So far all the forms have been kept in the one genus *Peltoperla,* but *P. cora* will doubtless become at least a subgenus.

EXPLANATION OF PLATE 20

Fig. 1. *Pteronarcys spinosa*, anal part of fore wing.
Fig. 2. *Harrisiola flavescens*, anal part of fore wing.
Fig. 3. *Clioperla ebria*, anal part of fore wing.
Fig. 4. *Perlodes signata*, anal part of fore wing.
Fig. 5. *Peltoperla maria*, anal part of fore wing.
Fig. 6. *Acroneuria lycorias*, anal part of fore wing.
Fig. 7. *Isogenus frontalis*, anal part of fore wing.
Fig. 8. *Walshiola montana*, anal part of fore wing.
Fig. 9. *Kathroperla perdita*, anal part of fore wing.
Fig. 10. *Diploperla*, anal part of fore wing.
Fig. 11. *Clioperla similis*, basal part of fore wing.
Fig. 12. *Banksiana kansensis*, anal part of fore wing.
Fig. 13. *Pictetia expansa*, anal part of fore wing.
Fig. 14. *Hydroperla subvarians*, basal part of fore wing.
Fig. 15. *Isoperla bilineata*, anal part of fore wing.
Fig. 16. *Isoperla transmarina*, anal part of fore wing.
Fig. 17. *Diploperla bilobata*, basal part of fore wing.
Fig. 18. *Perliola 5-punctata*, forking of cubitus.
Fig. 19. *Hastaperla brevis*, anal part of fore wing.
Fig. 20. *Togoperla immarginata*, basal part of fore wing.
Fig. 21. *Atoperla fumipennis*, basal part of fore wing.

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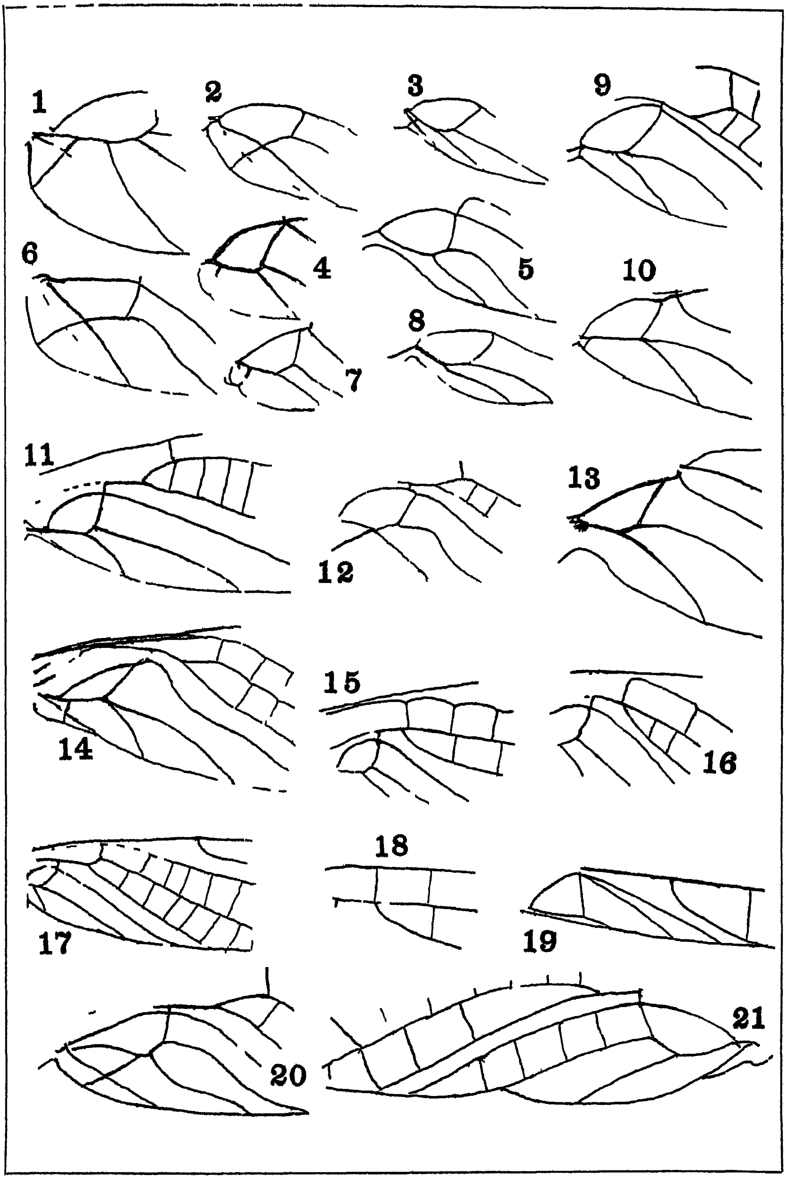

Banks—Perlidæ

EXPLANATION OF PLATE 21

Fig. 22. *Periphanes*, femur.
Fig. 23. *Calliperla*, femur.
Fig. 24. *Diploperla bilobata*, femur.
Fig. 25. *Togoperla immarginata*, femur.
Fig. 26. *Occiperla* sp., femur.
Fig. 27. *Hastaperla brevis*, femur.
Fig. 28. *Alloperla imbecilla*, femur and tibia.
Fig. 29. *Isoperla*, femur.
Fig. 30. *Hydroperla*, femur.
Fig. 31. *Isogenus*, basal portion of antenna.
Fig. 32. *Perlesta*, basal portion of antenna.
Fig. 33. *Isoperla bilineata*, basal part of antenna.
Fig. 34. *Hastaperla*, basal part of antenna.
Fig. 35. *Alloperla*, basal part of antenna.
Fig. 36. *Isoperla? mohri?*, basal part of antenna.
Fig. 37. *Diploperla modesta*, basal part of antenna.
Fig. 38. *Walshiola montana*, basal part of antenna.
Fig. 39. *Megahelus bellona*, basal part of antenna.
Fig. 40. *Neoperla clymene*, basal part of antenna.
Fig. 41. *Perlodes signata*, basal part of antenna.
Fig. 42. *Acroneuria*, basal part of antenna.
Fig. 43. *Clioperla maculata*, basal part of antenna.
Fig. 44. *Calliperla luctuosa*, basal part of antenna.
Fig. 45. *Perla* and *Togoperla*, basal part of antenna.
Fig. 46. *Isogenus frontalis*, maxillary palpus.
Fig. 47. *Diploperla bilobata*, maxillary palpus.
Fig. 48. *Perliola 5-punctata*, maxillary palpus.
Fig. 49. *Clioperla ebria*, maxillary palpus.

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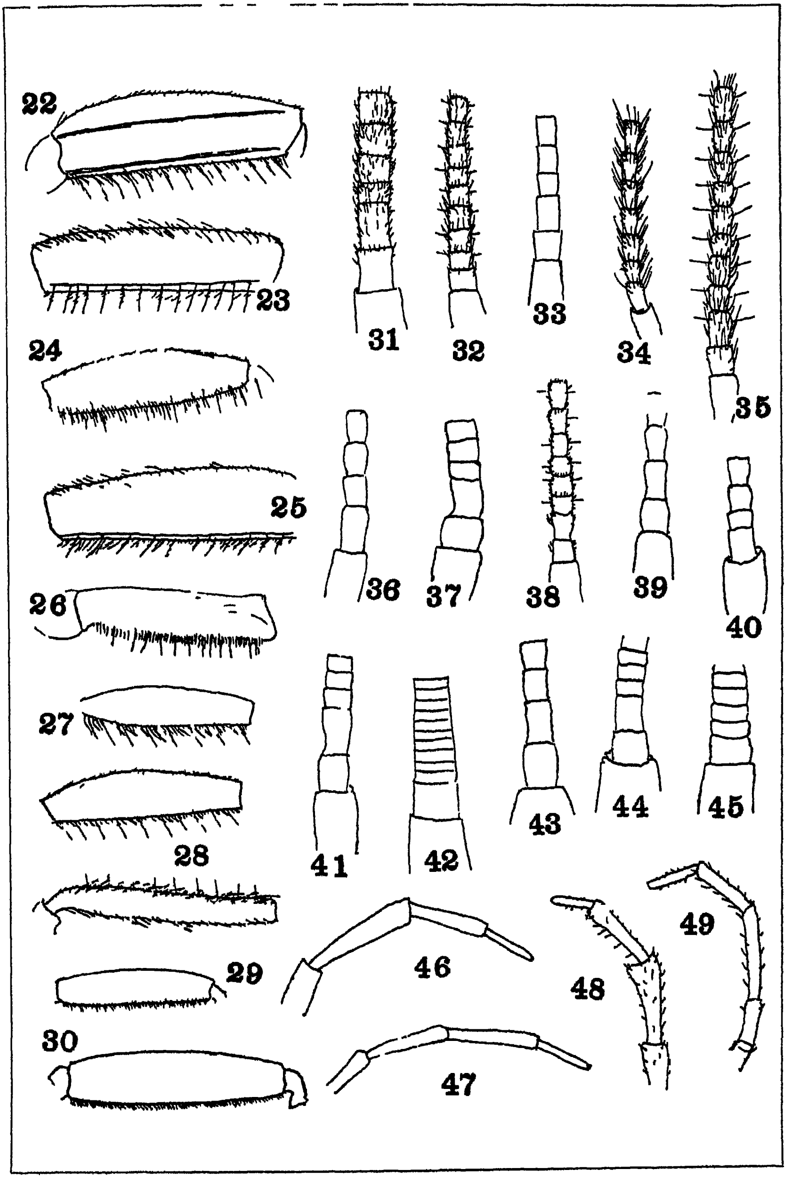

Banks—Perlidæ

EXPLANATION OF PLATE 22

Fig. 50. *Togoperla immarginata*, maxillary palpus.
Fig. 51. *Peltoperla maria*, maxillary palpus.
Fig. 52. *Isoperla bilineata*, maxillary palpus.
Fig. 53. *Harrisiola flavescens*, maxillary palpus.
Fig. 54. *Alloperla coloradensis*, maxillary palpus.
Fig. 55. *Perlesta*, maxillary palpus.
Fig. 56. *Kathroperla*, head.
Fig. 57. *Harrisiola*, ocellar area.
Fig. 58. *Perliola 5-punctata*, ocellar area.
Fig. 59. *Hydroperla hastata*, ocellar area.
Fig. 60. *Isogenus frontalis*, ocellar area.
Fig. 61. *Perla capitata*, ocellar area.
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Fig. 74. *Togoperla immarginata*, ocellus and boss.
Fig. 75. *Walshiola montana*, ocellus and boss.
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Fig. 77. *Alloperla borealis*, ocellus and boss.
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Fig. 79. *Eccoptura xanthenes*, ocellar area.
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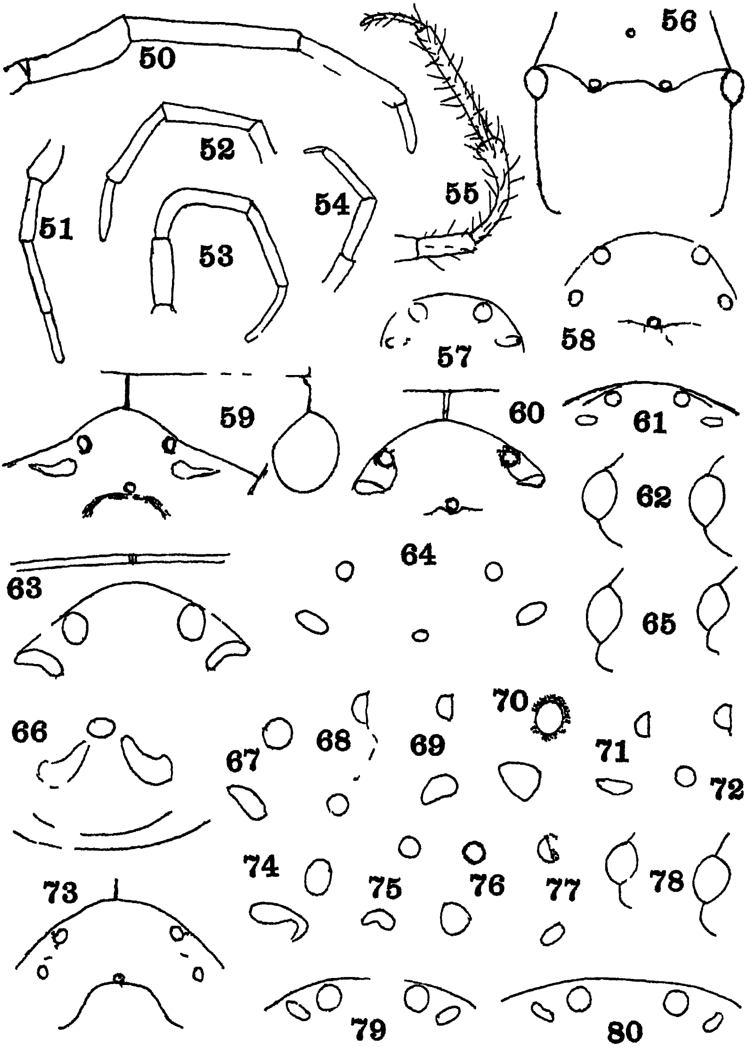

Banks—Perlidæ

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